CLEAN AIR

VOL.12 NO.1

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NATIONAL SOCIETY FOR CLEAN AIR
49th ANNUAL CONFERENCE
LLANDUDNO
18 – 21 OCTOBER 1982

Subjects will include – Use of Coal by Industry, Domestic Heating, Noise Abatement Zones, Neighbourhood Noise, Noise from Road Vehicles, Control of Construction Site Noise, Air Pollution Related Health Risks, Pollution in Buildings and Underground Facilities, Corrosion by Atmospheric Pollution on Materials, Atmospheric Pollution from the Agricultural and Quarrying Industries

Keynote Address to be given by Lord Flowers, FRS

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CLEAN AIR

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Contents

Use of an Environmental Audit Procedure
J.A.H. Oates 3
Pilot's Licence 8
Coke oven fumes – health & safety guidance 11
International News 12
One-day Teach-In of the Economics of Pollution Control: Report
R.T. Jarman and H. Dawson 15
Hereford Combined Heat and Power Station
M.E. Price 17
New Anti-Lead Campaign 29
Smoke Control 32
Obituaries 34
Industrial News 36
Index to Clean Air 37

Index to Advertisers

British Steel Corporation, Environmental Control Department cvr. ii
Central Electricity Generating Board cvr. iv
Coalite Group Limited cvr. iii

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NSCA AGREES LEAD-FREE PETROL OBJECTIVE

The Society's Council has just taken a major policy decision on lead in petrol, which has been a subject of considerable debate within the NSCA for a number of years. When the Government announced that the lead content of petrol would be reduced to 0.15 g/l by the end of 1985, the Society welcomed the intention to achieve a major reduction in lead emissions to atmosphere. At their last meeting the Council took the important final step — supporting the ultimate objective of lead-free petrol and declaring that this should be mandatory for all new cars at the earliest opportunity. "To this end the permitted lead content of petrol specified in EC Council Directive 78/611/EEC should be amended to eliminate the lower limit. Additionally the adequacy of the blood-lead standards specified in EC Council Directive 77/312/EEC should be reviewed, while the lead in air standards specified in the proposed EC Council Directive should be reviewed and developed to take account of the contribution of lead in the air to lead in dust levels."

This major statement of policy reflects the Society's primary concern for clean air and the decision of the Council that the elimination of lead in petrol is justified to control one route by which lead reaches the human body. The Society accepts that other sources of lead in the environment — which individually may be of major significance in particular localities — obviously require careful monitoring and control. Thus, the Society will continue to urge Government and other authorities that this be effected, and that public money be directed towards the elimination of all outstanding problems of lead in the environment.

USE OF AN ENVIRONMENTAL AUDIT PROCEDURE

J.A.H. Oates
Imperial Chemical Industries PLC, Mond Division, Buxton
(Presented to the East Midlands Division of NSCA on 10 September 1981)

1 INTRODUCTION

ICI operates two limestone quarries in the Buxton area of Derbyshire. The productive capacity of the larger, Tunstead Quarry, is about 6 million tpa while that of Hindlow Quarry is about 1 million tpa. About 50% of the stone quarried is calcined into quicklime, two thirds of which is produced on site.

In 1970, 20 lime kilns were operated at the two quarries, of which 15 were coal-fired shaft kilns, 3 were rotary hearth (Calcimatic) kilns and 2 were rotary kilns. In addition there was a lime grinding plant at Hindlow, and a lime hydrating plant and a cement plant at Tunstead.

At that time, the need to reduce the environmental impact of the Works was recognised. A team comprising a Production Manager, a Maintenance Manager and Technical staff was formed to carry out an Environmental Audit. This resulted in a programme of work which, over the past decade, has reduced markedly the environmental impact of the Works. An account of the approach and of certain aspects of the programme is given, which may be of general interest.

2 THE AUDIT PROCEDURE

The team assessed the environmental impact of each plant/operation under the headings of smoke, noxious gases, grit and dust, noise, vibration, liquid effluent and visual effects. It reviewed the available information and related it to any existing or proposed guidelines. It also considered the attitudes of staff at all levels. 32 recommendations were made and priorities were identified. The report concluded that two major programmes were required, namely —

a) to eliminate the emission of dark smoke from the 15 coal-fired shaft kilns, and
b) to reduce dust emission, especially from the kilns.

Following the first Audit, annual programmes were agreed. Progress was monitored by subsequent Audits which also identified any new problems and reviewed priorities. Throughout, close contact was maintained with the Alkali and Clean Air Inspectorate and the Local Authority. In later years, this was extended to include local councillors via the Local Liaison Committee.

3 DARK SMOKE

The coal-fired shaft kilns were each fired with a batch of coal every hour. Originally dark smoke (in excess of Ringelmann 2) was emitted for 20 minutes (Fig 1). By 1970, this period had been reduced to 6 minutes by injecting additional air above the point at which the coal was fired, but design limitations prevented any further reduction. Since the kilns were in groups of 7 and 8 units, dark smoke was emitted from each group almost continuously.

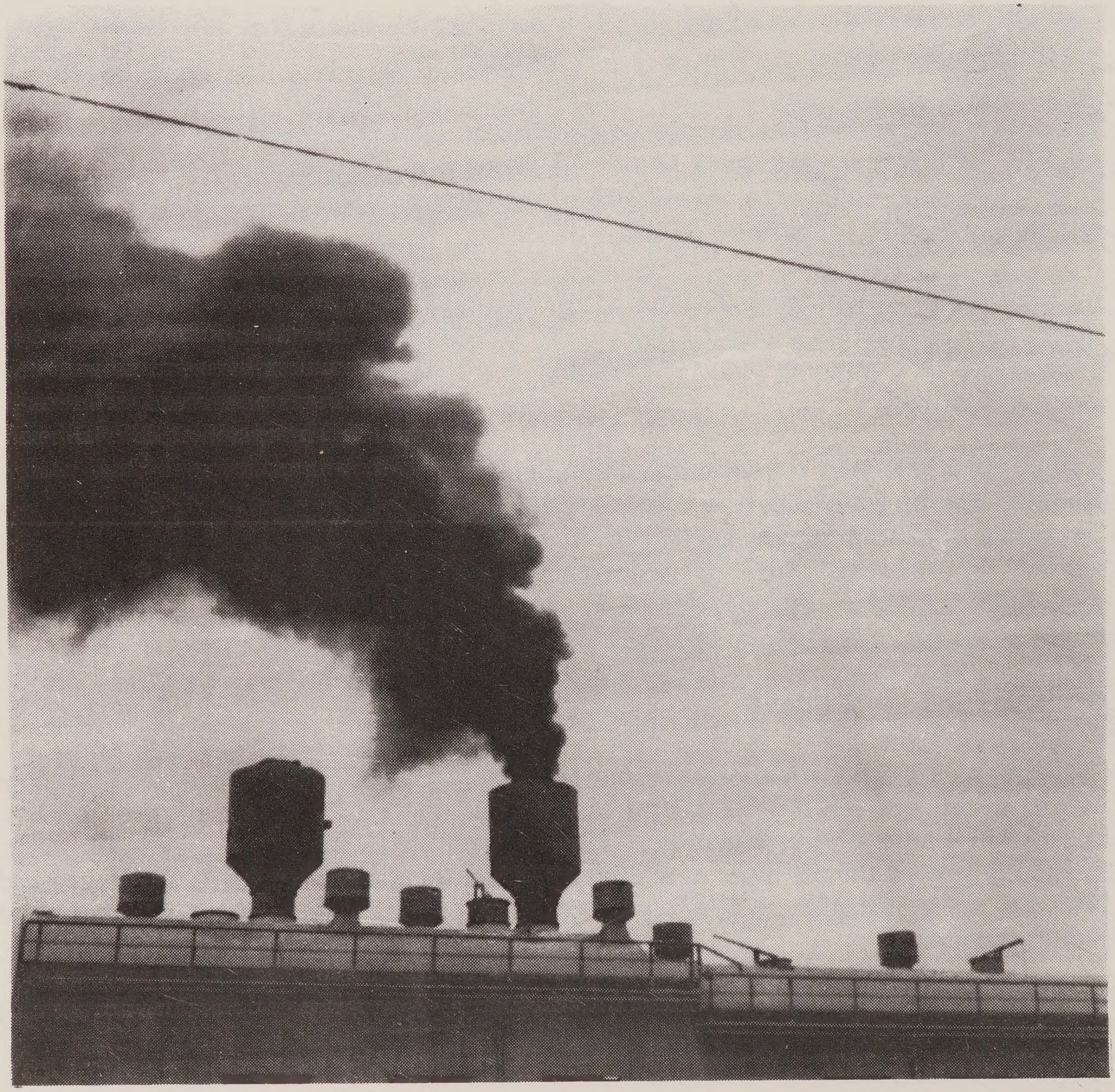


Fig 1. Dark Smoke Emission from No. 2 Shaft Kiln Tunstead (coalfired).

There were considerable environmental pressures to eliminate dark smoke emission. Indeed the Alkali Inspectorate set a deadline of the end of 1980 for the kilns to be shutdown or replaced.

At Tunstead, it was decided to convert the shaft kilns to a novel gas-fired design. One kiln was converted on an experimental basis in 1972. The experiment was a success and the other seven kilns were converted by 1977. The total cost in 1981 terms was £6.5 million, most of which was justified on environmental grounds.

The decision regarding the coal-fired shaft kilns at Hindlow was delayed until 1977. By then, changes in the costs and long-term availabilities of fuels had occurred. These and other factors led to the decision to replace the kilns with two gas-fired Maerz kilns (Fig 2). These were commissioned by the end of 1980 and the coal-fired kilns were shut down. The cost of this replacement was £(1981) 5.5 million.

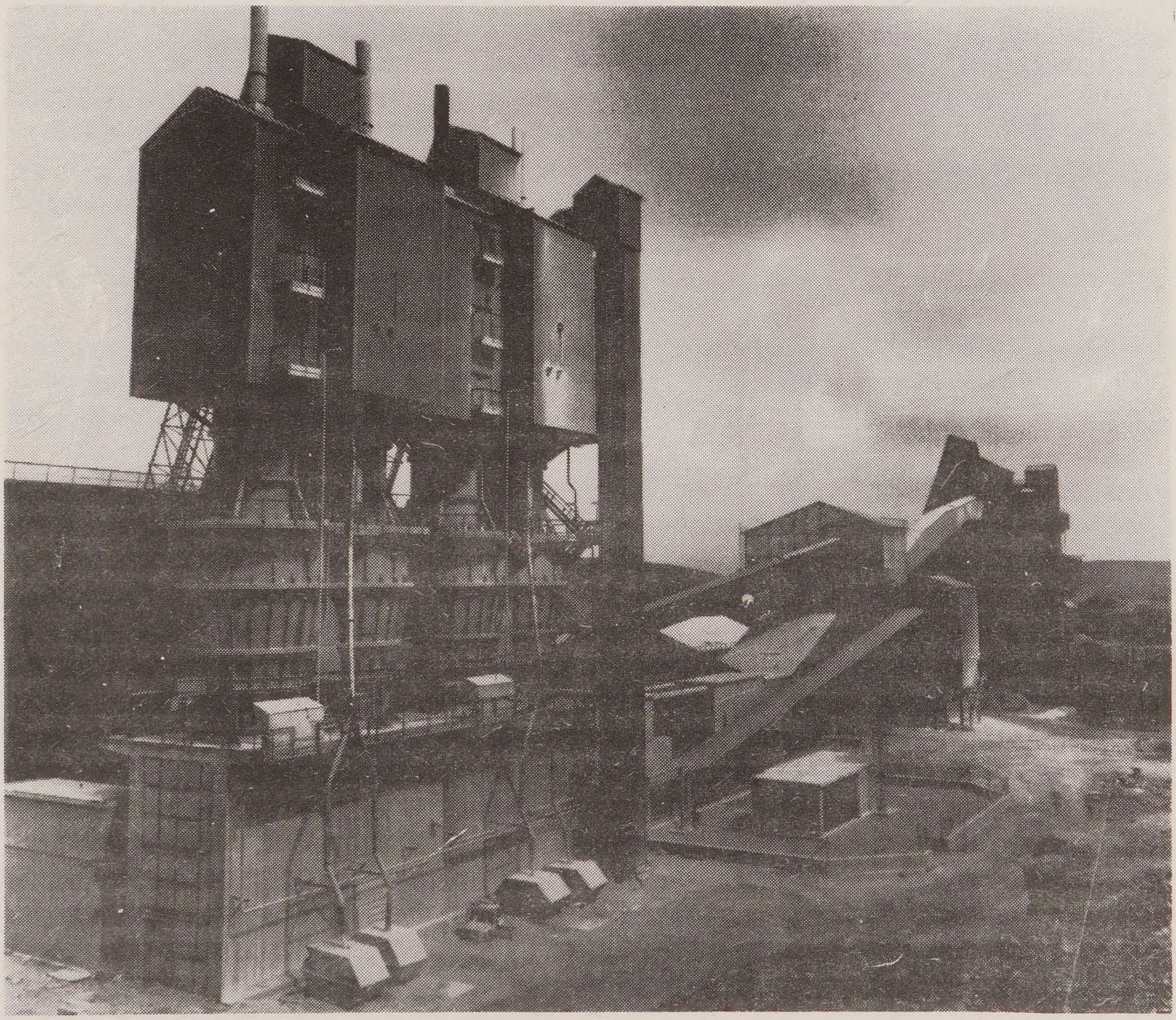


Fig 2. Hindlow Maerz Kilns (gas-fired).

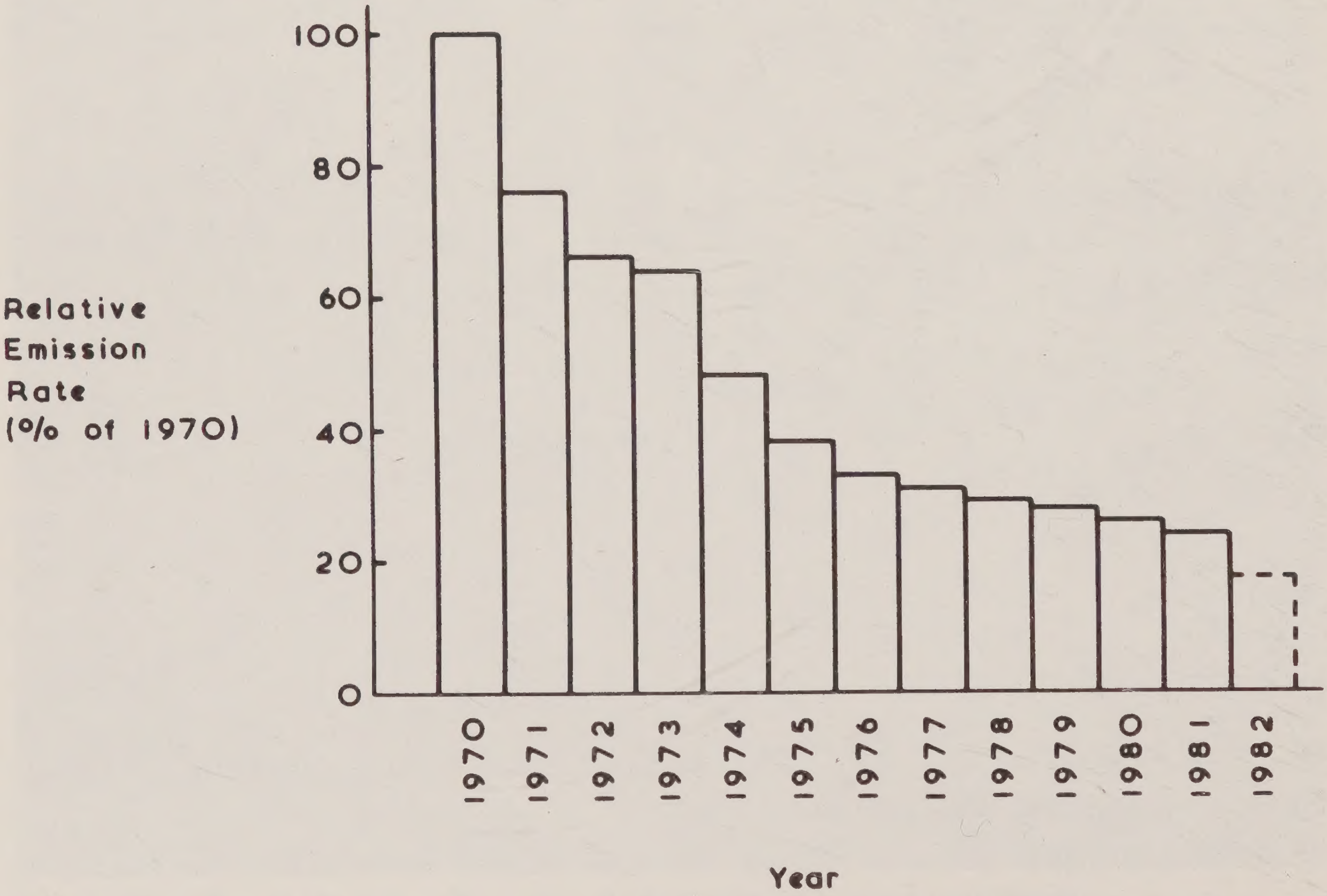
4 GRIT AND DUST

4.1 Tunstead

While gas-fired lime kilns are not, as yet, subject to the advisory dust emission limits set by the Alkali Inspectorate, it was accepted that they should be operated to those limits.

The conversion of the coal-fired shaft kilns to the gas-fired design reduced dust emission by a 5 times factor. The rotary hearth kilns had been installed with high efficiency cyclones, but problems were experienced with storage and disposal of the collected dust and with ancillary equipment. The use of enclosed containers, which were emptied on a routine basis, overcame the first problem. Improved maintenance and checking procedures mitigated the second. The rotary kilns were also equipped with high efficiency cyclones, but problems were encountered with dust handling. Three modifications of the system were tried before a satisfactory arrangement was obtained. The cement kiln was fitted with an efficient electrostatic precipitator to meet the requirements of the Alkali Inspectorate. Here again, operating problems were experienced with the dust handling system, which adversely affected the availability of sections of the precipitator. Major modifications to the dust handling system over the years resulted in progressive improvements in precipitator availability.

Estimated Relative Dust Emission Rates from Tunstead Works (1970-1981)



Many other modifications have been made to transfer points, crushers, screens, silos and loading out points. In addition there was a major programme to educate operating and maintenance personnel about the importance of attention to the detailed operation of dust collectors.

Fig 3 summarises the direct benefits of the programmes. Dust emission from the major sources in 1981 was about 20% of the 1970 level. Other improvements, which are in the pipeline, are expected to reduce the level to 15% by the end of 1982.

4.2 Hindlow

When the decision was made to install Maerz kilns, there was considerable debate as to the most suitable type of dust collector. The low availability of water at the site restricted the choice to bag filters, electrostatic precipitators or cyclones. The choice was complicated by the fact that the dust concentration from other Maerz kilns varied by a 10 times factor. A multi-cyclone collector was finally chosen as giving an acceptable efficiency with high reliability, compact size (which enabled it to be sited on top of the kilns), and lower cost than the alternatives. Measurements have confirmed that it removes 94% of the dust and reduces the emission to about 0.15 gr/SCF. For a given lime production rate, the amount of dust emitted from the Maerz kilns is about 20% of that formerly emitted from the coal-fired shaft kilns at the site. The cost of dust collectors plus noise control measures (see next Section) amounted to £(1981) 300,000.

5 NOISE

Various noise control measures have been implemented to reduce both internal and external sound levels, eg use of rubber screens, fitting improved silencers on drill compressors and purchase of quieter dump trucks and shovels.

The major action in connection with a purely environmental noise problem was the fitting of silencers to five fans on the rotary hearth kilns. Initially, under certain atmospheric conditions, the pure notes produced by these fans had been audible at distances of over 3 miles.

Similar problems had been encountered with Maerz kilns installed elsewhere. The blowers which supply air to the kiln are noisy and produce powerful pure notes which can radiate from the pipework leading to the kiln. To prevent this at Hindlow, the blowers were fitted with inlet and outlet silencers and were housed in a substantial building fitted with acoustic doors.

6 FUTURE DEVELOPMENTS

There are plans to reduce emissions on certain plants. More significantly, perhaps, the need is recognised to ensure that current standards are maintained. To this end, emission levels are checked on a routine basis.

Changing economic factors will necessitate further modernisation of the Works and opportunities will arise to reduce emission levels. In this context, the best practicable means concept is regarded as being very important. This involves weighing the technical practicability and cost of adopting more stringent standards with the resulting benefits. Generally, the law of diminishing returns applies, so that excessively stringent standards result in disproportionately high costs. Such costs are inevitably passed on to the customer and ultimately to the public in general.

7 SUMMARY

Use of a procedure based on Environmental Audits has, over a period of 10 years, resulted in substantial reductions in emissions. The procedure consisted of three stages —

i) identification of areas needing improvement and agreeing priorities,
ii) setting realistic targets based on the best practicable means principle, and
iii) implementing actions in line with a realistic programme which made efficient use of the limited available resources.

PILOT'S LICENCE

Of all the issues currently occupying our attention, the biggest by far in sheer volume of paper — the file is at least six inches thick — is that of straw and stubble burning. While every harvest can be guaranteed to produce a supporting crop of complaints, every few years the barometer sets fair at warm and dry, and with the zephyr winds of Indian summer wafting the smoke and little pieces of partly burned straw over the countryside, the holocaust proceeds against a background chorus of dissatisfaction rising in a crescendo reminiscent of the last few bars of Tchaikowsky's 1812!

1981 was such a year. The chorus was heard over much of England, from Cheshire to the Channel and from Suffolk to Offa's Dyke. By mid-August, the national press was banging on about smoke hazards on the M4 and by the first week in September the burn had become a general topic for editorials in the local press and on radio. Judging from the reports which have since reached this office, it was also occupying the time of a good many Environmental Health Departments. If most farmers carried out the operation efficiently, effectively and safely in accordance with the NFU Straw and Stubble Burning Code it was also apparent that many did not. Indeed, so flagrant and so frequent were the exceptions that even the NFU is now calling for the maximum fine for those successfully prosecuted under local Bye-laws to be raised to £1000. Many may see even that level of penalty as being totally inadequate for those farmers who use burning tyres to set their fields alight. But regardless of the deterrent, the first thing to establish is an offence, and Bye-laws are not much use where the nuisance is generated miles away. Nor does the Clean Air legislation offer a better alternative. Although prosecutions under S.16 of the 1956 or S.1 of the 1968 Acts may theoretically be possible, quite obviously their drafters did not have the farming industry in mind or Parliament would have required them to be appropriately specific: perhaps the Society should award an accolade to the first plaintiff to establish the precedent that dark smoke from a field can be as great a nuisance as that from a breaker's yard!

From start to finish the burning period lasted six weeks during which time countless thousands were exposed to a disamenity from which the farming industry, uniquely among all our other industries, is excused the rigors and expense of air pollution control. While some British farmers are not in favour of straw and stubble burning, their number appears to be dwindling, and the problem is therefore exacerbated not only by the vagaries of British weather, but by farmers making increasing use of minimum cultivation techniques in an expanding cereals industry. In 1961 about 2.7 million hectares were devoted to cereals in England and Wales. These were estimated to have produced about 9.5 million tonnes of straw in addition to that remaining on the stubbles. By 1971 there were about 3.1 million hectares under cultivation in England and Wales and the NFU estimate for 1981 is 3.4 million hectares. Give or take point one of a decimal last year's straw production was around 12 million tonnes. While it goes without saying that a farmer will never burn straw if he can find an economic use for it, produced on this scale it is clear that the surplus must be tremendous.

It would not be unreasonable to assume that the last harvest produced a total burn of almost five million tonnes of straw and 2.1 million hectares of stubble. Little wonder then that a pilot flying over Hampshire likened the countryside to a "Devil's Cauldron".

Raising the matter at the Brighton Conference in October, Cllr. J.C. Blewitt of the South Oxfordshire District Council said that in his opinion the transport of black smoke caused by straw and stubble burning had become such a major problem that the disadvantage now presented to the general population of the country outweighed the benefits to the farming industry. He called for the Society to reconsider and report anew on the problem; the report to be used as a discussion document as well as for information. Emphasising that he had not the slightest desire to hurt the farming industry, he said he would welcome practical measures to eliminate or alleviate the problem. From the applause which Cllr. Blewitt was given it was evident that he had the backing of all the delegates, and the Session Chairman promised to refer the matter to the Society's Council.

Meeting in December the Council decided that as a first step, the Ministry of Agriculture, Fisheries and Food and the National Farmers Union of England and Wales should be informed that the Society:

— considers that from the environmental point of view the burning of straw and stubble as now being practised has become unacceptable with the balance of argument for permitting its continuation being outweighed by the objections of the citizens —

— is unconvinced that the grounds for excusing the farming industry from comparable provisions regulating smoke and particulate emissions as apply to all other industries can be sustained —

— would be grateful to receive a detailed case justifying the continuation of the practice which would convince the nation at large.

Acknowledging our request, the Minister of State, the Earl Ferrers, replied as follows:

"I acknowledge your disquiet. It is, indeed, a difficult and long-standing problem, and I am certainly most concerned at the number of complaints which have been received following the 1981 harvest. The problem seems to have been greater last year than for some time, possibly owing to the burning season having been more limited than usual owing to adverse weather conditions.

Much research and development has gone on over the years into finding alternative uses for straw — some 5 million tonnes of which are surplus to farm requirements each year and which have to be disposed of as swiftly and economically as possible. My own Department has been closely involved in this research, much of which has been initiated, funded and co-ordinated by us.

Although a great deal is now known about alternative uses for straw, and a number of potential processes have been identified, it has unfortunately been difficult to make much progress in getting them adopted on a scale which is sufficiently large to make an impact nationally. The main reasons for this have been the geographical separation between the main cereal and livestock producing areas; the lack of sufficient labour for, and the high cost of, baling straw to allow it to be transported economically either to livestock farms or to processing plants; and the large capital investment required in all the potential industrial processes which have so far been identified. I am bound to say that it is difficult to see how this position can be greatly altered in the foreseeable future. We are left, therefore, with this large quantity of bulky material to be disposed of. Burning — despite its drawbacks which as a countryman myself I recognise — is at present the only reasonable method for most of it.

There are, of course, good agricultural reasons, in addition to speed and cost, for continuing to burn straw. Whilst it may be that burning cannot control disease in the sense of overcoming it entirely, there can certainly be benefits, in conjunction with other methods, in reducing the incidence of disease, particularly where a following crop is planted soon after the harvest. The alternative of ploughing straw in can have serious husbandry disadvantages. Leaving it undecomposed at or near the soil surface presents a physical hindrance to the establishment of new crops, particularly where reduced cultivation techniques are adopted, and the residues can produce a toxic environment which hinders the growth of new cereal plants during the establishment phase.

I can assure you that I respect your concern, which I share, and I am not content with the position. We are continuing to investigate alternatives to burning — for example by improved techniques for ploughing in. My officials are in close touch with the NFU to see what can be done in the short term in order to improve matters for the 1982 harvest. I am afraid, however, that I cannot agree that the situation has been reached where the balance has swung against continuing to permit straw to be burnt."

The reply from the NFU first referred to a number of accompanying technical papers and then continued:

"In the light of the overwhelming technical and economic arguments in favour of straw burning, the NFU has long been concerned to ensure that the practice is undertaken with the minimum of annoyance to the public and damage to the countryside. The NFU Straw and Stubble Burning Code has been frequently revised since its inception 17 years ago.

The annoyance caused by smoke and smuts was, by all accounts, particularly serious last year. It is our understanding that a long period of warm, dry weather during which wind speeds were low, was responsible for severely exacerbating the problem; smoke was not dispersed quickly, while smuts were carried high into the air by thermal currents before being deposited, sometimes many miles from their origin, to the annoyance of the public.

You may be aware that, partially in response to these problems, a Working Party was convened under the chairmanship of the NFU's Vice-President, Mr. C.P. Righton, to examine the ways in which the annoyance caused by burning could be further reduced and to examine related aspects of the subject. Both the Ministry of Agriculture and the Country Landowners Association are represented on the Working Party.

Apart from initiating moves to achieve an increase in the fine for offences against the straw burning byelaw, the Working Party is examining a proposal to introduce a power to ban serious offenders from burning. We have also investigated alternative methods of surplus straw disposal: there appears to be potential for more use of straw in industry where it can be used in the manufacture of paper, livestock feed, building materials and chemicals. Finally, the Working Party is undertaking a review of the advice contained in the code and the manner in which it is presented.

It is unfortunately our experience that, while damage to hedgerows can be avoided simply by the creation of an adequate firebreak and the use of common sense, the problems caused by smoke and smuts are more intractable. While we believe that, following the development of economic alternatives to burning, as outlined above, the need for the practice will diminish, we would welcome the views of your society as to the means by which the annoyance caused by smoke from straw and stubble fires could be otherwise minimised."

As this issue goes to press there the matter stands awaiting the next meeting of the Standing Committees. In the meantime, I would be delighted to hear from you on the subject.

John Langston
Secretary General

Guidance on controlling operator exposure to fumes and smoke from coke ovens published

The Health and Safety Executive have published guidance notes which are aimed at reducing the health risks of workers in coking plants. Epidemiological studies have revealed an excess proportion of lung cancer deaths amongst coke oven workers of the order of 20% greater than would be expected. Coke oven fume contains known cancer causing agents such as the polycyclic hydrocarbon, benzo(a)pyrene.

The Steelmaking National Industry Group compiled the notes following extensive consultations with management and trade unions in the industry, and with the involvement of HM Alkali & Clean Air Inspectorate. Coking plants are of course Scheduled works and these Guidance Notes are therefore complementary to the Alkali Inspectorate's Notes on the Best Practicable Means for Coke Works. The control of emissions at source is the fundamental objective and emphasis is placed on the vital part that all levels of personnel have to play. High standards of operational control, maintenance and housekeeping are all essential. Guidance is given on the regular (weekly) monitoring of all coking batteries in order to identify the grade emissions of smoke and fume. Records of monitoring and any follow-up action are to be kept available for inspection by HM Inspector of Factories and by any employee from the work-force concerned.

However, because the hazards cannot be overcome by engineering controls and maintenance alone, "an onerous requirement is placed on individual workers to use the respiratory protective equipment which will be provided for this work". In saying this, Mr. Jim Hammer, Chief Inspector of Factories, acknowledged that it would be a "difficult feature" and pointed to the role of management, trade unions and factory inspectors in "explaining the risk and emphasising the need for coke oven workers to adopt this form of self-protection".

Reducing Operator exposure to fumes and smoke from coke ovens. Available from the Health & Safety Executive, Brunel House, 2 Fitzalan Road, Cardiff CF2 1SH. Price £1.50.

INTERNATIONAL NEWS

An IUAPPA publication

ROAD VEHICLE EMISSION CONTROLS

Federal Republic of Germany

Talks between the Federal Ministers of the Interior, Economics and Transport and leading representatives of the German automobile industry in July 1981 have produced a longer term strategy for reducing vehicle emissions and saving fuel. The automobile industry will continue the voluntary step-by-step reduction of car exhaust gas pollution in accordance with the ECE regulation no. 15, series 04. This means a further reduction of around 20% depending on the type.

The automobile industry will further develop their motor vehicles with the objective of reducing the amounts of pollutants in the exhaust gases, while taking into account the need for further fuel savings. As the Federal Government is striving for a harmonisation within the European Communities, in June 1981 it put forward a recommendation for a uniform reduction of the pollutant threshold values within the EEC. The following values would apply: 30 - 48g CO/Test and 10g (NO_x + HC)/Test. This would bring about a further reduction of around 50%.

The automobile industry maintains that test results in accordance with the current state-of-the-art of engineering have shown that these threshold values cannot be attained. The Federal Government does not share this opinion. It was agreed that a joint committee of experts would try to settle this difference.

Switzerland

The Swiss government is to retain stringent emission standards for petrol-engined vehicles. From October 1982 standards will be the same as those in Sweden: 2.1 g/km HC, 24.2 g/km CO and 1.9 g/km NO_X – all according to the CVS (Constant Volume Sampling) method.

On October 1, 1986 levels will be: 0.9 g/km HC, 9.3 g/km CO and 1.2 g/km NO_X.

According to EEC Environment Commissioner, Mr. Karl-Heinz Narjes, the Swiss Government's decision to adopt unilateral vehicle emission standards may be in breach of the Swiss Free Trade Agreement with the European Community.

USA

The U.S. Supreme Court has ruled that the Environmental Protection Agency acted "responsibly" in setting a diesel particulate standard of 0.2 grams per mile for 1985 light-duty vehicles and a 0.26 gram per mile particulate standard for light trucks. Diesels emit nearly 100 times more particulate matter per mile of travel than gasoline engines do. These particulates are minute and when inhaled tend to come to rest in the deepest reaches of the lungs. Known to be carcinogenic in animals, there is concern that they may also be harmful to humans.

EEC

EC 'Seveso' Directive

The European Commission has recently agreed a directive (the "Seveso" directive) which obliges companies that manufacture or use a wide range of chemicals to identify the risks present in their local factories and to tell workers and local residents what those risks are. It is an attempt to prevent industrial accidents such as the 1976 Seveso disaster, and the Directive should come into force by 1984.

FEDERAL REPUBLIC OF GERMANY

Coal Study

A DM 3.7 million coal study has been commissioned by the Federal Ministry for Research and Technology (BMFT) and is being carried out by the Department of Applied System Analysis at the Nuclear Research Centre in Karlsruhe. The study is to assess and evaluate the consequences of strategies for an expanded use of coal in the Federal Republic of Germany, assuming that the use of nuclear energy will be well below earlier projections. The study will analyse technical and economic requirements, environmental and human health risks, and the political measures necessary to implement a strategy of increased coal use. The environmental impacts to be considered include the effects on the health of the general population and on the labour force employed in the coal industries (mines, conversion plants, etc.). The impact on the natural environment, including the global climate, will likewise be investigated, in terms of emissions from coal production and conversion facilities, the possibilities for emission control, and a critical review of the relevant environmental protection and occupational health and safety legislation.

The project was started at the beginning of the year and is expected to be completed some time in 1983.

Conference on Fibrous Dusts, Strasbourg 1982

The Commission for Clean Air of VDI is preparing an *International Conference on Fibrous Dusts* which will be held in Strasbourg, France, Palais des Congres, from October 4 to 8, 1982. This interdisciplinary meeting is being prepared by the VDI-Kommission Reinhaltung der Luft (Clean Air Division of the Association of German Engineers), Dusseldorf, in co-operation with the Association pour la Prevention de la Pollution Atmospherique (APPA) and the Centre Interprofessional Technique d'Etudes de la Pollution Atmospherique (CITEPA), Paris.

The programme will cover the following topics:

Techniques for fibre measurements
Results of ambient air measurements
Epidemiological findings
Effect-related experimental results
Risk assessment
Emission sources
Emission control
Substitution of potentially noxious fibres

Interpretation (German, French, English) will be provided.

Further information can be obtained from the VDI-Kommission Reinhaltung der Luft, Postfach (P.O.B.) 1139, D-4000 Dusseldorf 1, F.R.G.

GREECE

Air Pollution in Athens — Citizens' Action Group to Fund New Study

Almost a year ago, a group of Athenians founded an association called "Citizens Against the Nefos", with the primary goal of funding a study on atmospheric pollution in Athens. The "Citizens" got together in this way because they felt that "despite the seriousness of the (air pollution) problem (in Athens), no satisfactory studies have been undertaken so far, either by state or private organisations. Whatever studies exist are biased by the political beliefs of those who have conducted them".

Accordingly, the association has raised $15,000 towards funding a study, and has written round to various governmental and non-governmental bodies in the UK, and presumably in other countries, asking whether they are interested in carrying out the proposed study (with or without the collaboration of interested Greek scientists). *Citizens against the Nefos* have also sought advice on how such a project should proceed.

While we know that several UK organisations have replied with information and advice on various means of carrying out surveys, we have not heard that any UK group has agreed to carry out a study on atmospheric pollution in Athens on behalf of the Association. Anyone, or any organisation, interested in doing so should contact Dionyssis Skalos, Citizens against the Nefos, Solonos 72-Massalias 1, Athens, Greece.

One area of study into the effects of atmospheric pollution has already been tackled in

Athens. The Committee for the Preservation of the Acropolis initiated a new survey, in 1980, on approximately 20 materials including zinc cans, Cu, Al, Steel, Stainless Steel, building materials and ceramics. About 12 sites are involved.[1] Earlier corrosion surveys, which examined the deterioration of the Acropolis monuments, have been written up in papers by Prof. Th. N. Skoulikidis and other authors.[2]

1. Saunders, K.G. Effects of Air Pollution on Materials – An International Debate. *Clean Air* (UK) Vol. 11, No. 4.

2. Skoulikidis, Prof. Th. N. Corrosion problems in Greece (1) & (2) *Corrosion Prevention and Control*, 1979.

One Day Teach-in on the Economics of Pollution Control

The Teach-in on the Economics of Pollution Control was held at Bristol Polytechnic on the 24th November 1981, and was attended by approximately 75 delegates. It was organised by the South West Division of the NSCA in conjunction with Headquarters. It was planned that Mr. Arthur Palmer, the local MP who, as Vice Chairman of the Parliamentary Select Committee on Energy, is very concerned with such technical matters, would take the chair. Unfortunately he had to go abroad at the last minute, so Mr. A. Archer, the President of the Institution of Environmental Health Officers, kindly took over.

The meeting was to discuss effective pollution control and how it can lead to tangible economic benefit due to reduced waste, improved fuel efficiency and other features, even during a period of economic recession. It started in an informal way with coffee served in the small exhibition area next to the meeting room. Exhibits – provided by:

Bristol Research and Associates Ltd.
The Central Electricity Generating Board
Erwin Sick Optic Electronics Ltd.
Jordan Engineering (Bristol) Ltd.
Leybold Heraevs Ltd.

attracted appreciable interest and many delegates returned for a second look in the lunch break. Dust monitors, chimney cleaning equipment and various instruments were on show. In addition the NSCA provided some of the posters entered in the recent National Poster Competition.

The first theme – the effect of low growth on both industry's attitude to pollution control and the health and safety implications – was introduced by two lectures. In the first Mr. M.F. Tunnicliffe, the Deputy Chief Alkali and Clean Air Inspector, described "How the problem of low growth has determined industry's attitude to environmental pollution control". He explained that the Inspectorate's policy was to maintain standards on plant. In new process plant air pollution controls generally represent 5-15% of the total capital requirement and in his experience this is normally accepted by industry and requests for mitigation have been rare, even in times of severe economic stress. However, he went on to point out that in a number of other countries financial assistance was provided for installing and up-dating pollution control equipment. This had led to the profitable export of such equipment from some of these countries and clearly some UK trade in this field was at present at a certain disadvantage as a result.

Mr. A. Watterson of Southampton University spoke on "The Trade Unionist's Role in Industrial Air Pollution Control in the 1980's" pointing out that trade unionists now wish to influence the decisions on environmental control standards. He went on to illustrate his concern with a number of examples.

The discussion period, opened by Mr. D.J. Barnett, Chief Environmental Health Officer of Bristol, was lively and the chairman had to call it to a close to proceed to the next theme on the agenda.

The second theme was how efficient engineering can reduce air pollution in particular cases. It was illustrated by a lecture on "Clean Air from Gas Turbines" by Dr. Sotheran, the Chief Combustion Engineer of Rolls Royce, and one on "The More Efficient Use of Solid Fuel" by Dr. D.W. Gill of the Coal Research Establishment at Stoke Orchard. In the first lecture Dr. Sotheran showed how research on improved combustion has lead to the more efficient use of fuel, less air pollution and so laid the basis of a financially attractive gas turbine industry. Following this lecture, after lunch, Dr. Gill described how the Coal Board's development programme aims to improve existing boiler technology, and encourage new development such as fluidised bed combustion, to expand the industrial use of coal. He went on to point out that the new methods produce less pollution by improved utilisation of the coal, so that The Flowers Commission on Energy and the Environment considered that for the majority of applications, the increased use of coal in industry should be positively encouraged.

The third and final part dealt with the impact of two innovations — The Severn Barrage and Microprocessors — development on somewhat different scales to say the least! Dr. T.L. Shaw, the Project Manager of Sir Robert McAlpine and Sons Ltd. gave an excellent presentation explaining how the Severn Barrage could produce electricity and catalyse long-term employment, besides leading to improvement in navigation and recreational facilities. After explaining how the technical problems are being dealt with, he went on to point out the need to form a type of company soon, where all interested parties would be represented, to plan the practical implementation as a whole in a way that would maximise the benefits to all people concerned.

The last contribution by Mr. M.S. Whitfield the Computer Engineering Manager, of Rolls Royce, entitled "Microprocessors in Pollution Monitoring and Control" dealt with the subject in a provocative way. He explained that while the microchip is a very exciting electronic development, it performs similar functions to collections of earlier electronic devices, such as valves, transistors etc. connected to other expensive equipment. Therefore, while the microchip may lead to better process controls on plant, in the field of pollution monitoring he considered that its impact would probably be small.

The final discussion period, opened by Mr. H. Giblin, Chairman of the Council of the NSCA, produced some interesting comments and the meeting closed on time. This teach-in broke new ground in considering some of the financial benefits that can accrue from pollution control. The organisers provided a variety of papers over this wide field and the speakers were all to be congratulated on the high standards of their provocative and informative presentations, which held the attention of all their audience all the time. They deserved the thanks of all those present. An additional benefit is that some of the exhibitors may now join the N.S.C.A.!

R.T. Jarman
H. Dawson

HEREFORD COMBINED HEAT & POWER STATION

M.E. Price

Midlands Electricity Board, UK

Paper given at the Meeting of the National Society for Clean Air's West Midlands Division, held at the Combined Heat and Power Station, Moorfields, Hereford, Tuesday October 20 1981.

The philosophy of Combined Heat and Power has not been developed to a high degree in the United Kingdom for many reasons, but there are several isolated stations which have operated successfully for several years, where the economic conditions are acceptable. It is true to say that the lack of development is not due to lack of a mandate, since the Electricity Supply Act going back as far as 1947 required the Electricity Supply Industry to investigate the possibility of sale of heat produced in the generation of electricity. However, the philosophy of maximising electricity output without regard to overall thermal efficiency, meant the quality of reject heat was very low and virtually unmarketable. This, coupled with the development of very large Power Stations of 2000 MW_e capacity which produce surplus heat of the order of 4000 MW_h meant that modern large scale generation could not easily be adapted for combined heat and power.

This does not mean that these large Power Stations were badly designed or operated, quite the contrary, they are probably technically equal to any stations anywhere in the world, they are also absolutely essential to provide the U.K. with the bulk generation that is so necessary for an Industrial Nation. It demonstrates however that such stations are relatively inflexible and retrospective re-design to meet new requirements half way through their life is not a practical proposition.

It becomes obvious in the short term, that if energy conservation is to be achieved by combined heat and power it will be necessary to change the design philosophies, from very large stations to relatively small stations satisfying the needs of local industry and commerce. However in the longer term it is feasible that large stations may be designed to meet the heating requirements of large cities and urban areas.

In many ways designs of all types of station are reduced to a single common denominator — Economics.

Any station designed to produce both heat and electricity must be economically viable whether it is built by the Electricity Supply Industry or Private Industry.

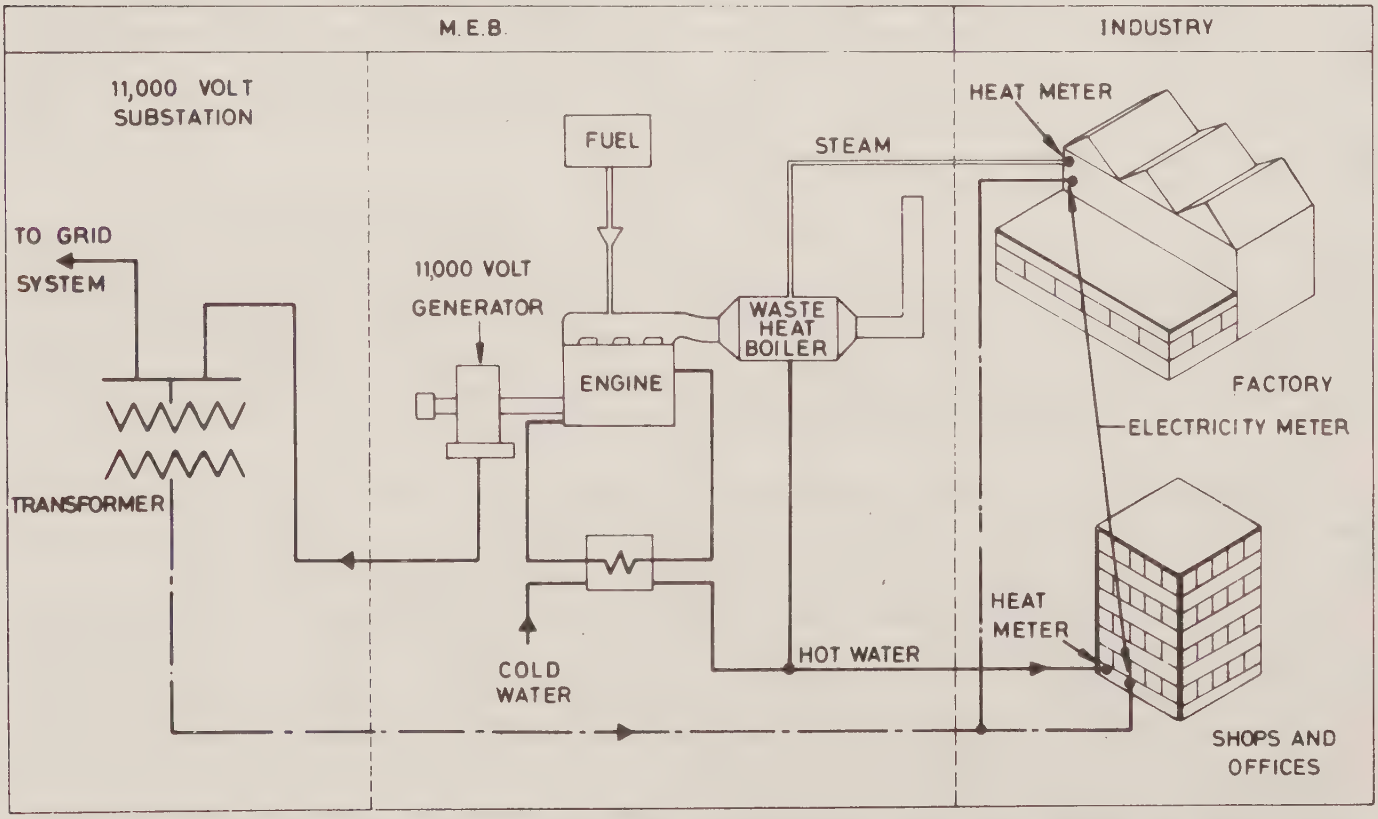
In the case of Private Industry engineers must place such a proposition before a critical Board of Directors more interested in marketable produce than engineering services, and who will require a very short amortisation of capital. However where large quantities of process heat are required the advantages are obvious. In the early days of the British Supply Industry some of the more enterprising industrialists used their surplus generating capacity to supply electricity to the village or town in which their factory was situated. These days there can be even greater advantages to be gained by having a supply of electricity to the factory, enabling exchanges of electrical power to take place when required or economically attractive.

In the case of the Public Supply Authority if a station is not economically viable then it may be interpreted that the station is being subsidised by the remainder of the Industry's customers. This situation is unacceptable and therefore it is of paramount importance that the project is profitable.

Bearing the preceding constraints in mind we at M.E.B. have thoroughly investigated something like 20 different schemes; the Hereford project is the first to satisfy all the requirements. The basic principle we have adopted for Hereford has been well tried in the marine field for many years. However, the constraints on design of a land based station are many and varied and the pure technological approach is not always strictly relevant.

The concept of integrating a combined heat/power station into the public electricity supply system (Fig. 1) removes the requirement of an energy balance which is the major obstacle that faces a private developer. As a consequence the station can be designed to match specific heat demands.

FIG. 1. SCHEMATIC DIAGRAM OF COMBINED HEAT AND POWER STATION



We do not have long cold winters and consequently the load factor on commercial and domestic heating systems is about 20%; this fact coupled with the tremendous cost of heat distribution systems tends to preclude the possibility of development of CHP purely for these markets.

Our experience has led us to look for industrial process heat load factors in excess of 50% to provide technical and economic stability for project. It is a bonus if additional commercial and domestic loads are available to accept lower grade heat for heating and and domestic hot water. At Hereford it became obvious very quickly that we had the nucleus of a successful project with two major well established companies, H.P. Bulmer Ltd., and Sun Valley Poultry Ltd., each with two local factories with a substantial heat load.

Initial calculations indicated an overall annual heat load factor of 55%. The daily load cycle is shown in Fig. 2 .

COMBINED HEAT AND POWER STATION - HEREFORD

DAILY HEAT LOAD CYCLE

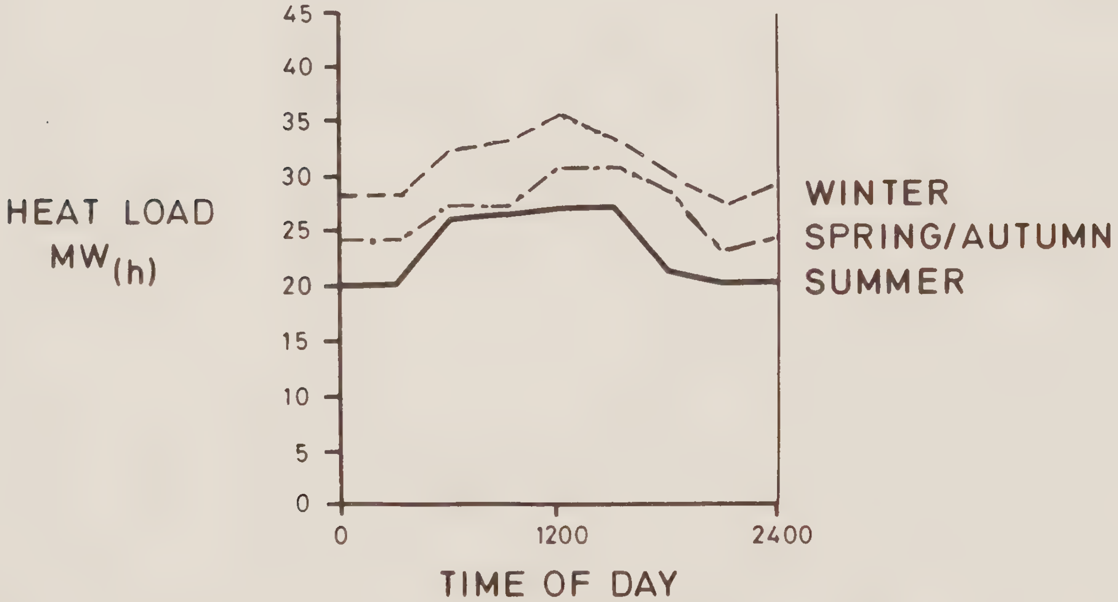


FIG. 2.

The design of the station was dependent upon three basic parameters:–

a) Heat consumers minimum heat demand

b) Minimum electrical load on the local networks

c) Short circuit rating of local supply system and switchgear

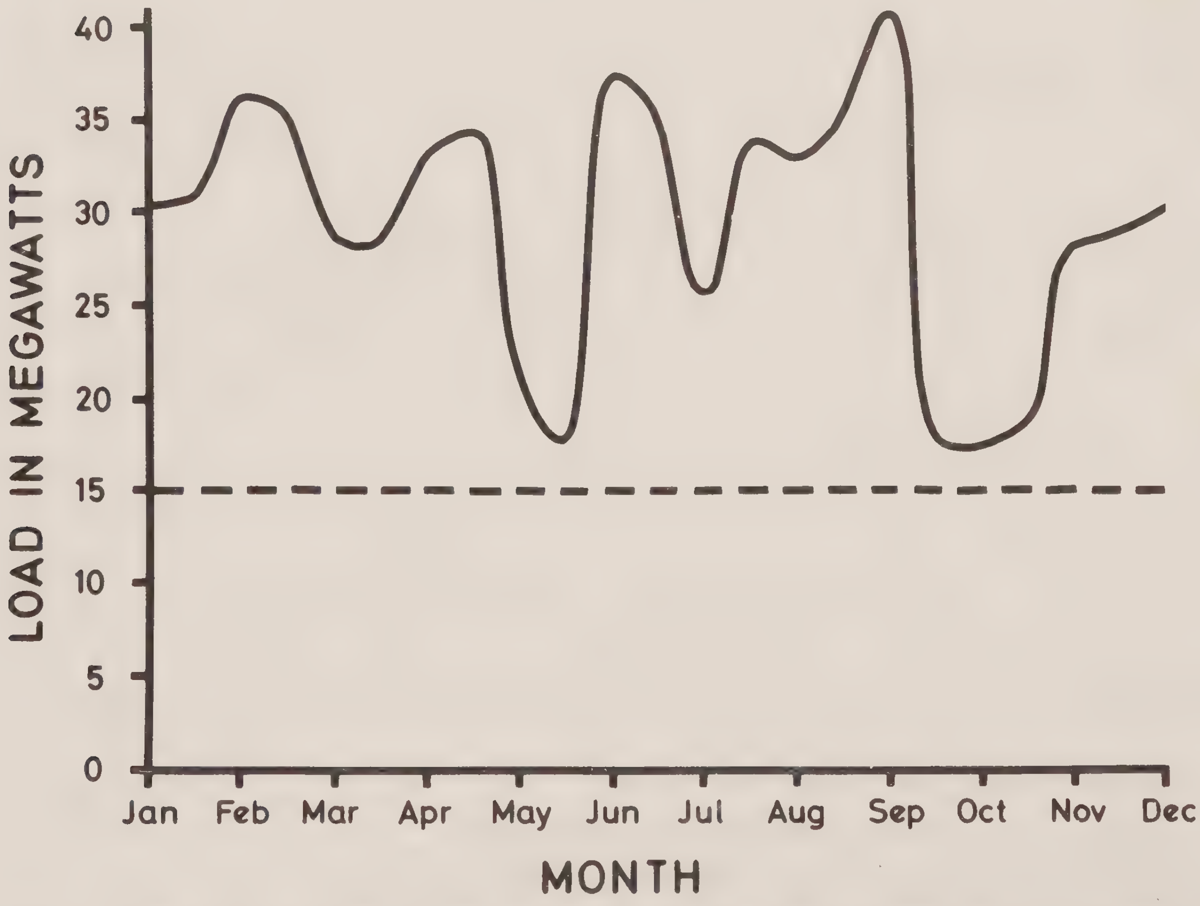
It is a basic requirement in marketing heat energy to be in a position to sell heat for at least 10 percent less than our customers can produce it for themselves, since industrialists will not sacrifice their independence without some financial benefit. This form of economic performance can only be achieved by extracting maximum conversion efficiency for fuel to power from the station over the maximum period of time. The Hereford station was therefore designed to operate under base load at all times.

Our customers were already operating process equipment with required heat in the form of dry saturated steam at pressures ranging from 7.0 bar to 17.5 bar; this equipment could not be easily modified and in consequence placed a major constraint on design. As a result the thermodynamic aspects of the station were not derived from thoughts of supreme station efficiency but by the dictates of the heat market. This meant that it was difficult to design for optimum overall efficiency for a given prime mover. For example in the case of the diesel engine there is a surplus of low grade heat. It can easily be seen from Fig. 2 that any output from prime mover and heat recovery system below 20MW_h would meet the required condition.

Considering now the electrical aspects of design, Fig. 3 indicates the annual load cycle on the local distribution network. Again it is easy to see that any output below the absolute minimum on this curve would meet the required base load condition for generation.

MINIMUM LOAD CURVE - HEREFORD 66kV NETWORK

FIG. 3.



The existing fault level at Hereford was 180 MVA; if two sets of 7.5 MW_e each were installed this would rise to 220 MVA max., and since all switchgear on the system was rated at 250 MVA, we were free to proceed with the following ratings for the station:

Electrical Output – 15 MW_e total – 2 sets 7.5 MW each

Heat Output from prime movers and heat recovery – 15 MW_h total, comprising steam and hot water

Peak Heat Requirement – 40 MW_h

The next problem was how to meet peak demands and design for relatively frequent heat load fluctuation. This could be achieved in either of two ways, either by supplementary firing of the waste heat boilers, or by simple addition of fired packaged boilers.

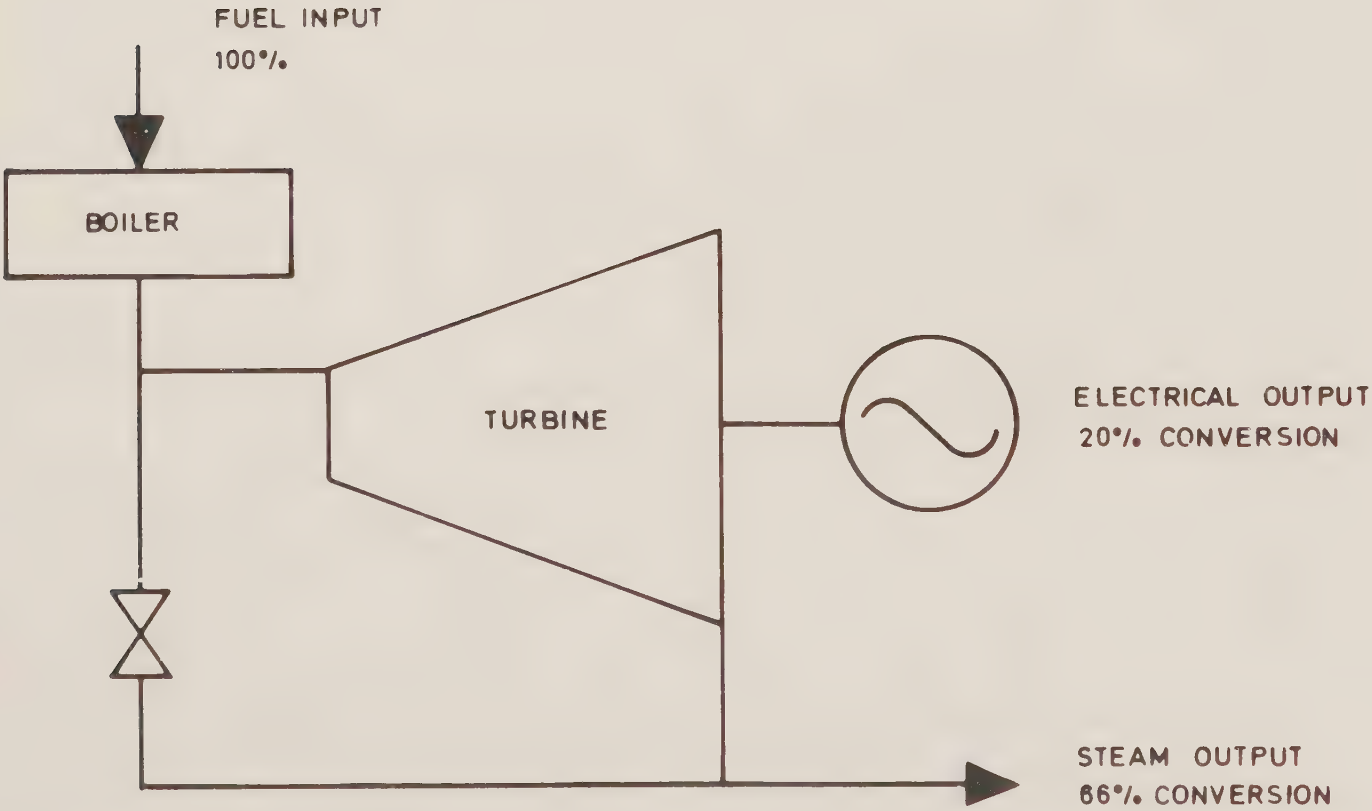
A cost analysis was carried out, and as there was no financial benefit in introducing the complication of supplementary firing the decision was taken to install oil fired boilers, operating on the same fuel as the prime movers.

Prime mover selection was the most crucial decision we faced, and we considered three options.

1) Back pressure steam turbine
2) Gas Turbine
3) Diesel Engine

The back pressure turbine generates power at nearly the ideal efficiency, however the magnitude of Power obtainable from a given steam flow is rigidly determined by supply steam temperature and pressure, exhaust and process steam pressure, and turbine internal efficiency.

FIG. 4. ENERGY BALANCE FOR A BACK PRESSURE TURBINE



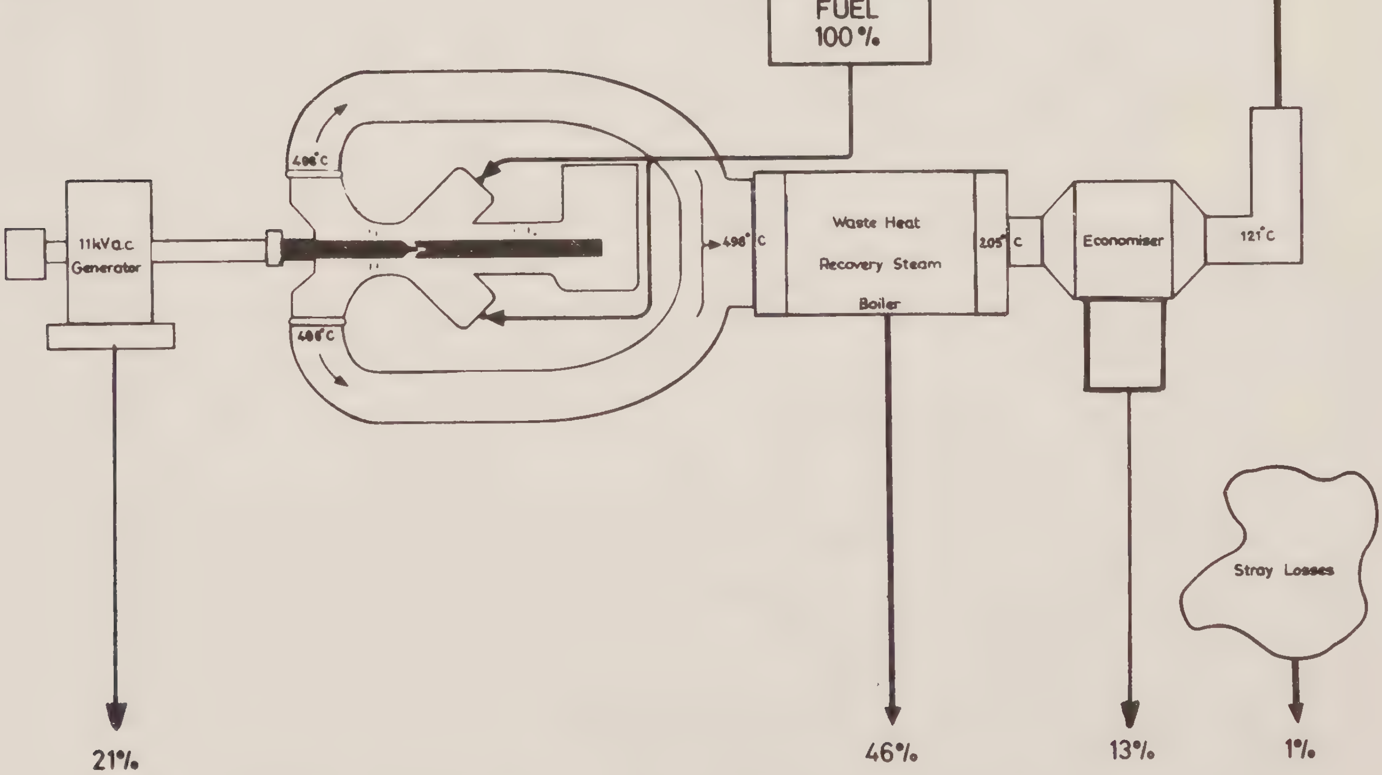
The back pressure for such a machine was determined by our customers existing equipment at 17.5 bar, and since we wanted to use relatively simple low pressure boilers operating below 25 bar the absolute pressure ratio across the turbine was low, with the result that the electrical output for the station was low.

A high thermal utilization of fuel to power and heat could be achieved from this design, but as Electricity is currently valued about three times as much as heat the economic balance for such a station was unacceptable, due to the low revenue produced from electricity. The only ways open to us to increase the output of electricity was to improve the turbine pressure ratio by increasing boiler pressure which would bring a rapid increase in cost, or to increase the throughput of steam, which would involve dumping heat. Neither alternative was very attractive.

The back pressure steam turbine was therefore discounted for the Hereford project.

Fig. 5 is an energy balance of a combined heat and power scheme based on the gas turbine. The critical feature in this is the efficiency of the prime mover. We investigated a range of gas turbines from the small industrial type with a thermal efficiency of 17% up to large aircraft derivatives with an efficiency of 26%. Fig. 5 is based on a 2.7 MW industrial type whose thermal efficiency is about 21%. Fig. 5 is not specifically related to the Hereford project but the principles may be applied. The overall thermal efficiency of this station would be about 80%. However to achieve this the exhaust gas temperature must be reduced to 120°C by heat extraction equipment; this can only be achieved

FIG. 5.



HEAT BALANCE FOR C.H.P. ENERGY SCHEME BASED ON GAS TURBINE GENERATION economically if premium fuel with an extremely low sulphur content is used. At present such premium fuels cost up to 50% more than residual fuels, and the market value of heat is approximately equal to the cost of such fuel.

A more detailed study of the gas turbine based scheme reveals that energy is consumed such that 21% is converted to electricity, 46 percent is converted to high grade heat, in other words the major energy conversion is in the form of high grade heat, which although being an important factor in the thermal efficiency of the system, would not produce sufficient financial revenue to support the cost of equipment.

If this principle was applied to the proposed heat balance for Hereford, then the electricity output of the station would be reduced to 5 MW_e if a base heat load of 15 MW_h was retained.

Again, although a very good thermal efficiency could be achieved with gas turbines the financial returns from such a project were unacceptable.

These difficulties led us to consider the diesel engine.

FIG. 6. HEAT BALANCE FOR SCHEME BASED ON DIESEL GENERATION

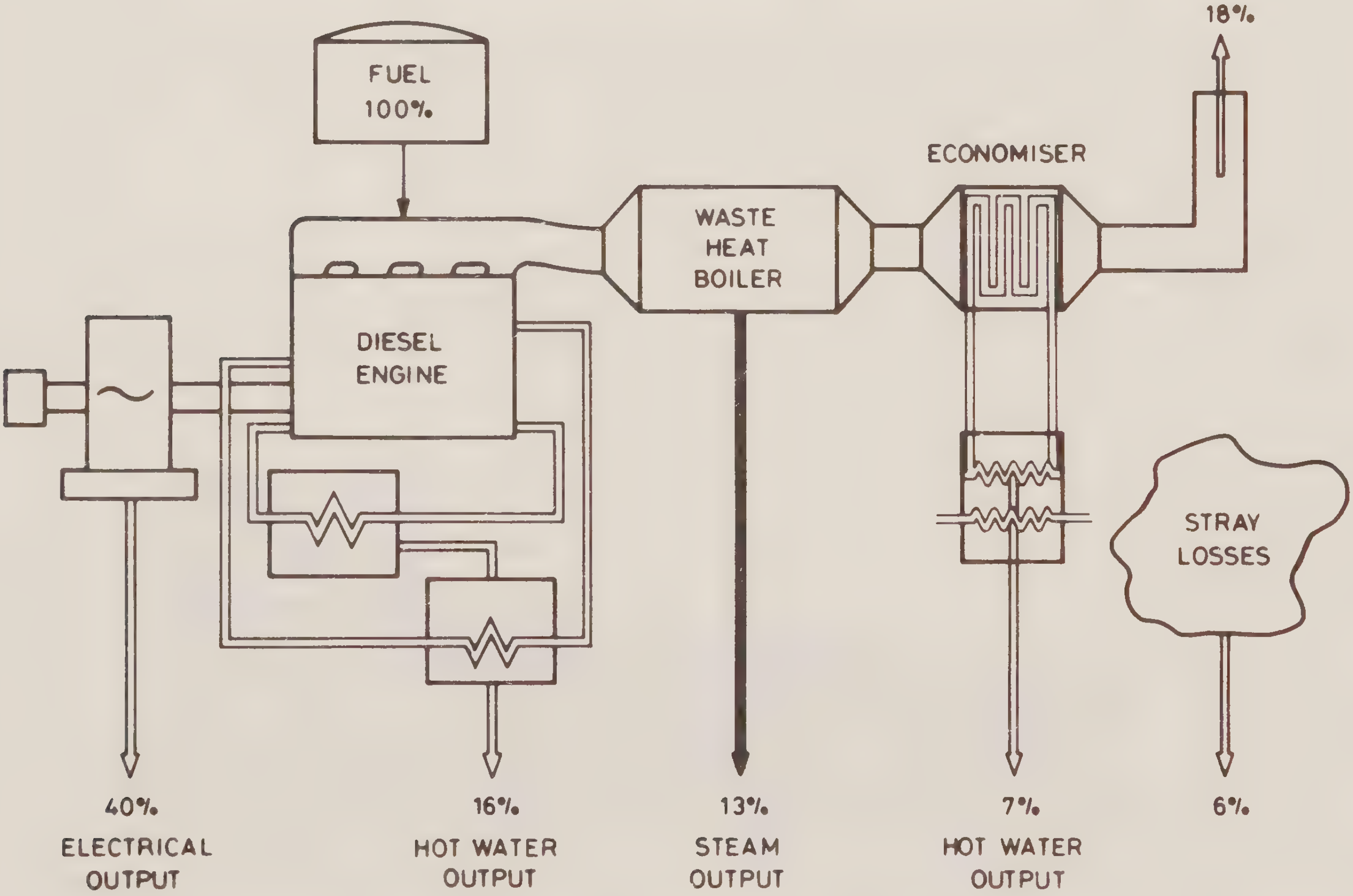
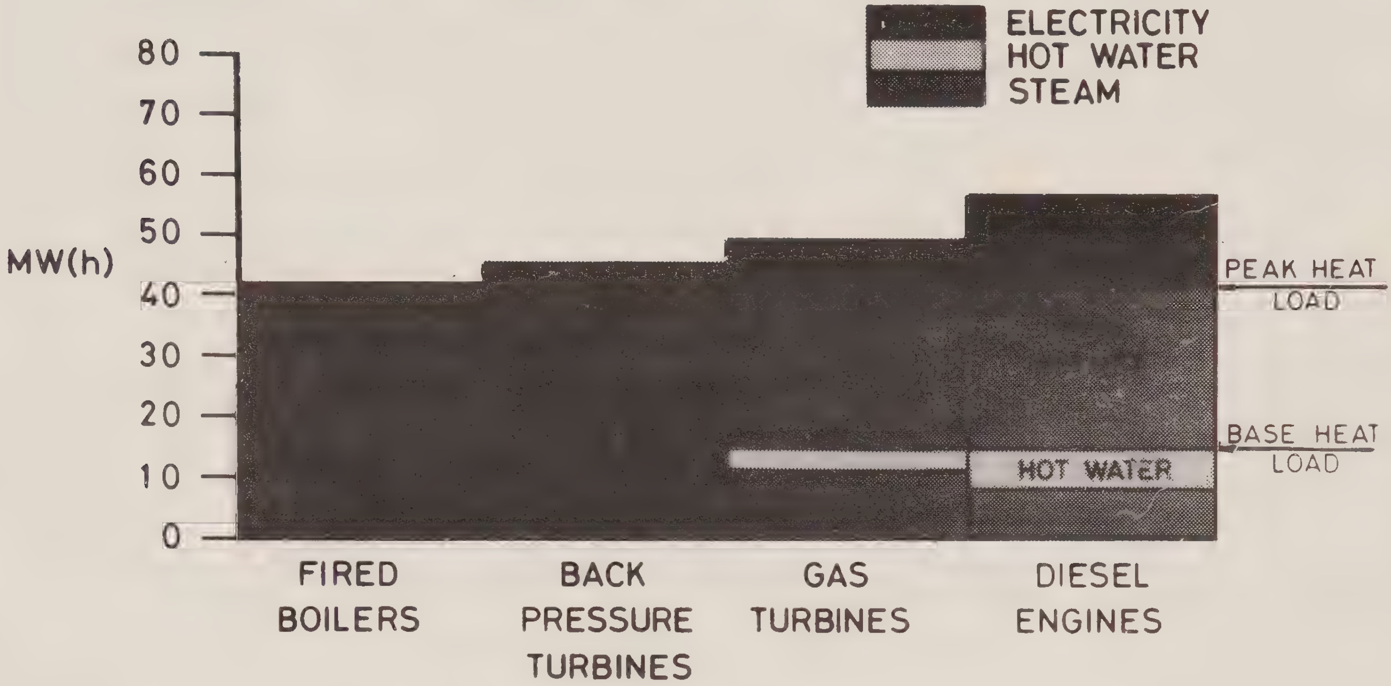


Fig. 6 is a heat balance for a C.H.P. scheme based on diesel generation. The energy conversion is biased in favour of electricity since the thermal efficiency of a large diesel

COMPARISON OF PERFORMANCE OF INDUSTRIAL C.H.P. SCHEMES

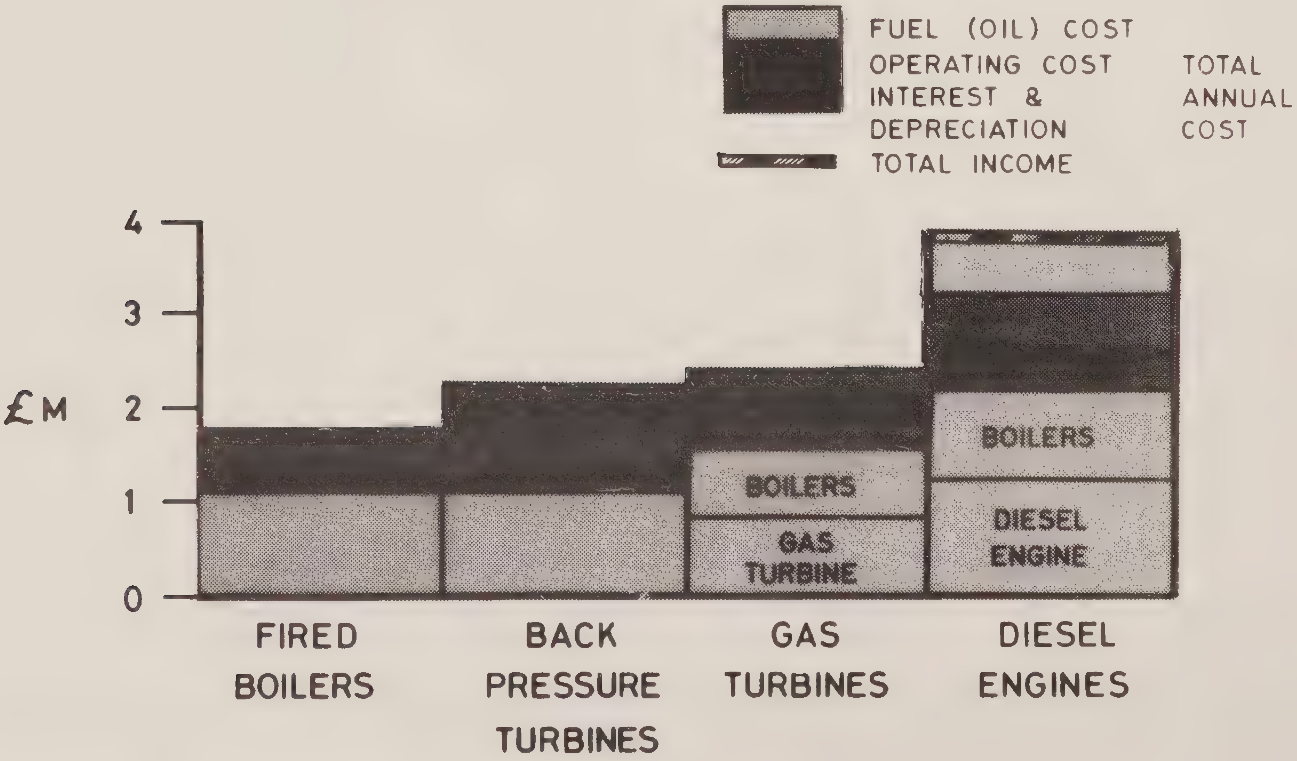
FIG. 7.

ENERGY OUTPUT PER HOUR ON FULL LOAD



ECONOMIC PERFORMANCE

Annual Costs and Income calculated on same basis for each scheme



engine is of the order of 40%. In addition the diesel engine has the advantage of being able to run on the relatively cheap residual fuel. There are obvious fundamental differences in the approach to heat recovery between the gas turbines and the diesel. The exhaust gas exit temperature is lower at approximately 425°C compared with 510°C and with the use of residual fuel the gas is very much more heavily polluted, particularly with sulphur. In consequence heat recovery equipment which reduces the exhaust gas temperature to a minimum of 176°C would be installed to avoid the acid dew point and consequent corrosion.

There is less recoverable heat in the exhaust gas of the diesel engine than in a gas turbine, but in addition to the exhaust gas there is a large quantity of lower grade heat in the various engine cooling systems, namely the jacket water, valve cage, lubricating oil, and charge air coolers. This heat is in the form of hot water at between 75°C and 80°C. The design thermal efficiency of the diesel based station would be 76% which is less than that of the gas turbine but it has two major advantages.

a) Cheaper fuel is used
b) Energy conversion is biased towards electricity which is the most valuable product

A comparison of economic performance of the various plant options for Hereford is given in Fig. 7. Clearly, the diesel based station was financially the most attractive.

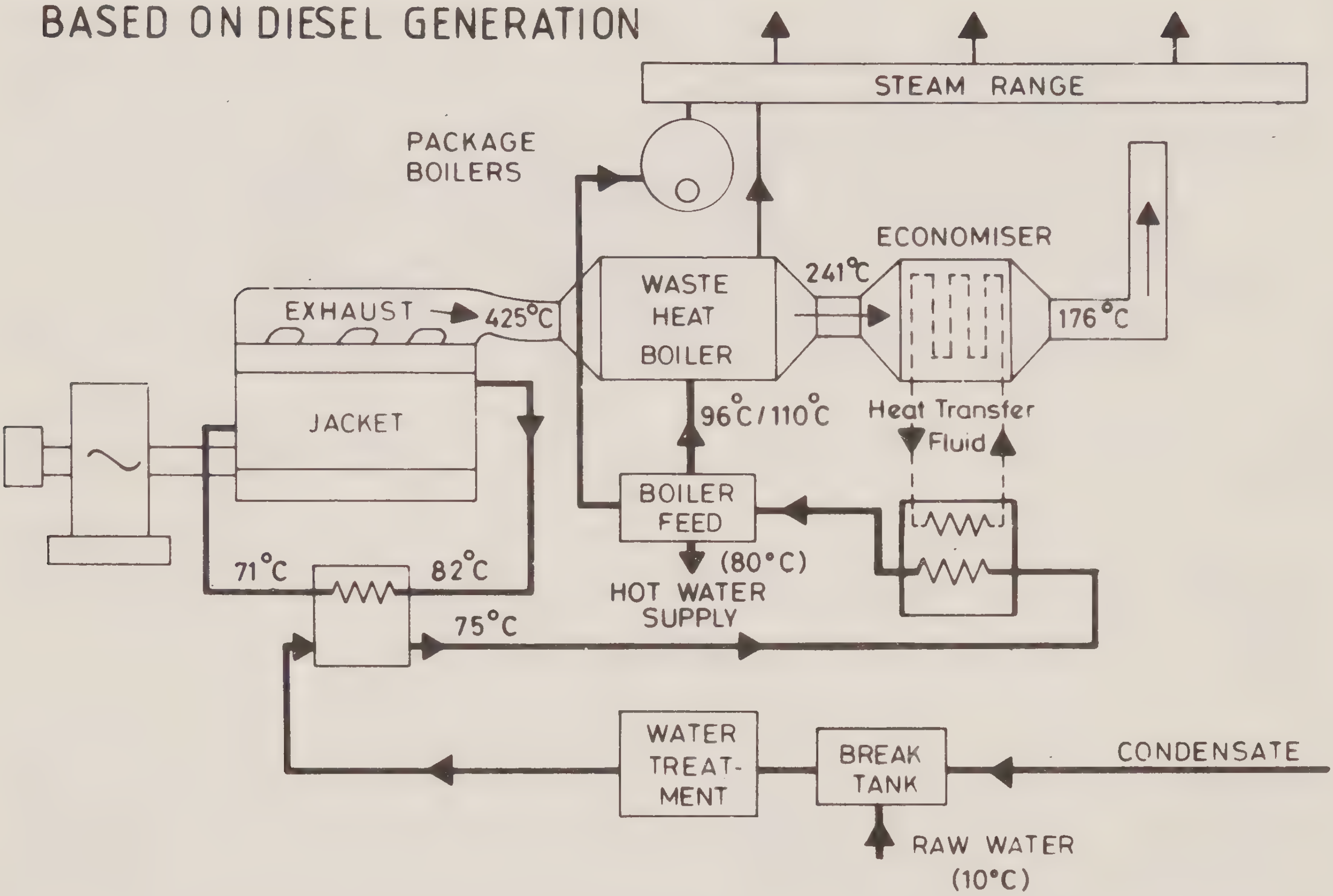
If we now consider the use of the low grade heat, the base load requirement is provided in boiler feedwater heating for both the waste-heat recovery boilers and also the fired boilers. Fig. 8 is a flow diagram for one of the diesel engines. For simplicity dump heat circuits which may be required in emergency have been excluded.

A particular point of interest is the use of a heat transfer fluid in the economiser system. This fluid is a mineral oil with high thermal stability, which means in simple terms it will not boil at temperatures very much higher than 100°C. For example, if a conventional water economiser operates at a temperature of 300°C, a pressure of the order of 100 bar is required to prevent boiling, with an added disadvantage that a complex control system is required to deal with flow variation. If a heat transfer fluid is used in the same system the pressure required is the pumping head necessary to circulate the fluid round the system. Virtually no control system is required. A disadvantage is that these fluids have a lower heat transfer coefficient than water and a larger heating surface is required to achieve the same heat output as a water system. The effect at Hereford is to achieve flexibility in the boiler feedwater temperature without a complex control system.

Fig. 9 is a sectionalised impression of the Hereford station. The disadvantages of using large medium speed diesel engines in an urban environment are well known, and at Hereford we have been particularly conscious of our responsibilities in this respect. Very considerable research has been carried out in relation to noise and vibration and the engine room has been designed throughout as an acoustic building using the existing background noise level as the datum. The waste heat recovery boiler is designed specifically as an acoustic attenuator and as a result additional exhaust silencing requirements are minimised.

The Hereford station is currently in the final stages of commissioning, and the results so far are very encouraging. On the practical side, there have been no real problems in the major plant items, the instrumentation and automatic control systems are due for completion within the programmed commissioning period, but delays occurred in the early stages due to industrial problems beyond our control.

FIG. 8. FLOW DIAGRAM FOR COMBINED HEAT & POWER STATION BASED ON DIESEL GENERATION



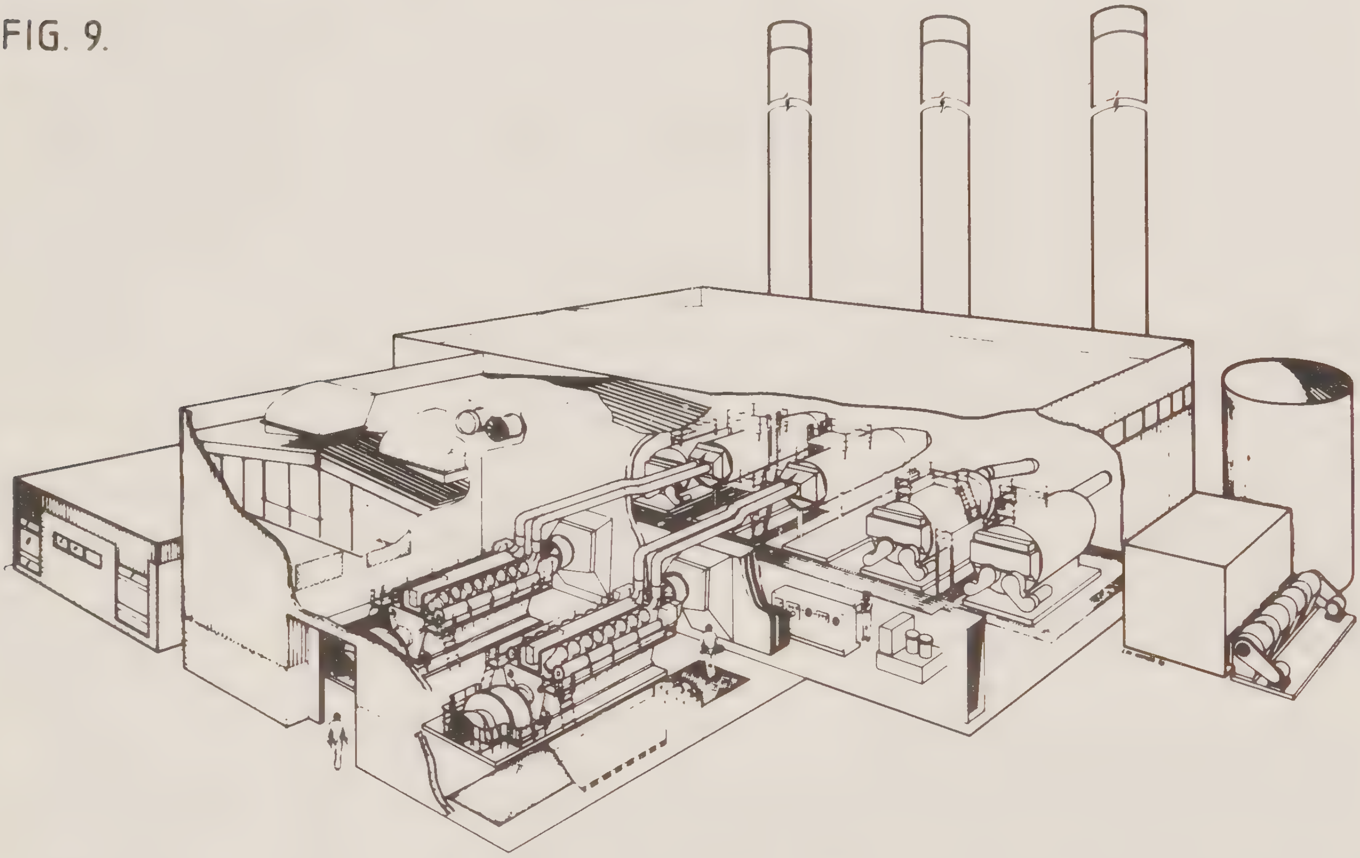
The station was officially opened by the Secretary of State for Energy, Mr. David Howell, on 2nd May 1980, and it produced its first operating profit at the end of June 1980. At this point the thermal efficiency of the station had reached 68%, and we anticipate the final thermal efficiency will exceed the design figure of 76% when commissioning is complete.

I would not wish to give the impression that the diesel engine is always the optimum for use in C.H.P. stations. It must be emphasised that each station should be carefully designed to specific conditions, and treated on its own merits.

We at M.E.B. have carried out theoretical studies up to an output of 100 MW_e, and it is interesting to note that at this point the advantages of the diesel engine diminish and the steam turbine takes over. Briefly the main reason for the change is that maintenance costs increase rapidly with the increase in the number of cylinders.

Another interesting feature is that the economics of C.H.P. thrive on high energy costs, and are less sensitive to capital costs, and although in 1980 it is difficult to establish an economic case for large scale domestic district heating, I think that as fuel costs increase and our fossil fuel resources decrease the picture could change rapidly. A reasonable analogy is that of our North Sea Oil. Ten years ago it would have been a brave man who said our oil fields would be a viable proposition, now they are invaluable, and their benefits are increasing daily.

FIG. 9.



My feeling for the future is that as energy conservation becomes more and more essential with rapidly rising costs there will be a strong case for large scale C.H.P. in the UK, even up to 1000 MW, for district heating integrated with the smaller M.E.B. style station tailored to meet the specific needs of industry.

NEW CHAIRMAN FOR THE INSTITUTION OF ENVIRONMENTAL HEALTH OFFICERS

Mr. Eric Foskett, Director of Environmental Health, Manchester, is the 1982 Chairman of the General Council, (the governing body) of the Institution of Environmental Health Officers.

Born in Derbyshire, Mr. Foskett has lived for most of his life in the Stoke-on-Trent area and embarked on his public health career in that city. After qualifying, he served between 1940 and 1946 in the Royal Army Medical Corps' field hygiene service, spending four years in the Middle East. After the war Mr. Foskett returned to Stoke-on-Trent City Council where he became Deputy Chief Public Health Inspector in 1961.

In 1967 he was appointed Deputy Chief Public Health Inspector to the City of

Manchester and two years later was promoted to the post of Chief. He became Director of Environmental Health at the time of local government reorganisation in 1974, when the old Manchester Health Department was disbanded.

He holds the Diploma in Public Administration of London University where he also graduated with B.Sc. Honours degree in Economics.

His special professional interests are environmental management, food safety and, more recently, occupational health and safety.

He is an adviser on environmental health to the AMA and represents that body on the national Liaison Committee on Health and Safety at Work; he is also the Chairman of the Local Authorities Management Services and Computer Committee's (LAMSAC) Computer Application Panel dealing with environmental health. Mr. Foskett is an examiner of the Environmental Health Officers Education Board, an external examiner of the Environmental Health Officers Education Board, an external examiner at Trent Polytechnic and former external examiner for the environmental science course at Salford University.

He is a Fellow of the Institution which he joined 42 years ago and a member of the North Western Centre Council since 1968. With a break of one year, he has represented the North Western Centre on the General Council of the Institution since 1974.

Mr. Foskett is married, has three grown-up children and lives in Poynton, Cheshire where he is actively engaged in Methodist Church work.

Noise in Motor Vehicles

BSI has published BS 6086 *Measurement of noise inside motor vehicles,* a new British Standard representing the first stage in the development of a test to define interior noise for engineering and contractual purposes. It is identical with ISO 5128, published by the International Organization for Standardization (ISO).

BS 6086 specifies conditions for obtaining reproducible and comparable measurements of noise levels and noise spectra inside all kinds of motor vehicles for use on the road, including those where the driver and/or passengers occupy an open cabin (or even only a well-defined area) but not agricultural tractors or field machinery (covered by ISO 5131). The results may be used, for example, to:

(a) Decide whether noise inside a vehicle is in accordance with noise specifications
(b) Estimate hearing damage risk in conjunction with noise exposure
(c) Rate the degree of speech interference
(d) Orient a programme of more elaborate measurements for the purpose of studying noise reduction procedures.

The method described in the standard is not intended for the measurement of pressure oscillations at very low frequencies, or the assessment of comfort and security aspects of noise exposure such as fatigue and vigilance.

Copies of BS 6086 may be obtained from the BSI Sales Department, 101 Pentonville Road, London N1 9ND. Price £8.00 (BSI subscribing members £4.00).

NEW ANTI-LEAD CAMPAIGN LAUNCHED

CLEAR – The Campaign for Lead-free Air, was launched at a London press conference on Monday, 25th January.

The eight organisations backing the campaign are: The Association of Community Health Councils for England and Wales, The Association of Neighbourhood Councils, CALIP, the Conservation Society, Friends of the Earth, The Health Visitors Association, Transport 2000, and The Advisory Centre for Education.

In addition to the campaign's committee, chaired by Des Wilson, there is an all-party parliamentary panel and a scientific and medical advisory board. Another organisation, The CLEAR Trust, will conduct research and a programme of public education. The two organisations are launching a public appeal for the £250,000 they believe is necessary to carry out a programme of activity designed to win governmental decision.

CLEAR is urging the Government to introduce the fixed limit of 0.15 grams per litre for lead in petrol earlier than the official date of 1985 and that this should be for *existing cars* only.

On 24 November 1981, new regulations regarding the lead content of petrol came into operation in the UK, which implemented the Government's decision to reduce the maximum permitted lead content of petrol from 0.40 grams per litre to 0.15 grams per litre with effect from 31 December 1985. The Regulations also increased the penalty for knowingly using, or permitting the use of, petrol with excess lead content from £50 to £200.

Other demands are: – that as soon as possible, and in any event by early 1985, all new cars sold on the UK market be required to run on lead-free petrol available for sale to the public; – that taxation on the sale of petrol should be imposed to create a price advantage to motorists purchasing lead-free petrol.

CLEAR also seeks to maintain surveillance on the use of lead generally and to encourage enforcement of any measures necessary to reduce lead pollution wherever it occurs.

The campaign's case against lead in petrol is based on the premise that lead in air contributes far more to total uptake of lead than was suggested by the Lawther Report.[1] The campaign stresses recent research on lead levels in dust, and new US research by D.A. Otto et al[2,3] on the effects of age and body lead burdens on central nervous system function in children. This research demonstrates adverse effects at blood lead levels as low as 7 ug/dl, and reinforces the CLEAR claim that levels of body lead far lower than the accepted safe level of 35 ug/dl could have an adverse effect, particularly on the health and development of young children.

CLEAR's objectives received support from 138 MPs before the campaign was publicly launched and Michael Foot, David Steel and David Owen sent letters of encouragement – although cynics may feel that such backing is a great deal easier to give while not in office. At the launch, which was given wide coverage in the press, Des Wilson indicated that he had some startling cards up his sleeve which would keep the debate alive and fuel public support for the campaign's objectives.

The first major card to be played was the release to *The Times* (8 February) of a letter written by **Sir Henry Yellowlees,** Chief Medical Officer at DHSS, on 6 March 1981 to Sir James Hamilton, Permanent Secretary at the Department of Education and Science. The letter was sent one week before a comprehensive report on Lead and Health was to go before the E(EA) Committee of the Cabinet leaving the matter for Ministerial resolution. The significance of the letter (both at the time it was written and when publicly released nearly a year later) can be assessed from the following extract:

> "There is no doubt that the simplest and quickest way of reducing general population exposure to lead is by reducing sharply or by entirely eliminating lead in petrol. The Environment Departments, Health Departments and Ministry of Transport are recommending a very considerable reduction of lead in petrol, but this is opposed by the Department of Energy and the Treasury on economic grounds.
>
> I must now make my own position clear. A year ago when the Lawther report was published there was a degree of uncertainty, but since then further evidence has accrued which though not in itself wholly conclusive, nevertheless strongly supports the view that:
>
> (a) Even at low blood levels there is a negative correlation between blood lead level and IQ of which the simplest explanation is that the lead produces these effects:
>
> (b) Lead in petrol is a major contributor to blood lead acting through the food chain as well as by inhalation.
>
> Further research is being mounted but we are dealing here with the biological sciences where truly conclusive evidence may be unobtainable and it is therefore doubtful whether there is anything to be gained by deferring a decision until the results of further research become available.
>
> There is a strong likelihood that lead in petrol is permanently reducing the IQ of many of our children. Although the reduction amounts to only a few percentage points, some hundreds of thousands of children are affected and as Chief Medical Officer I have advised my Secretary of State that action should now be taken to reduce markedly the lead content of petrol in use in the United Kingdom.
>
> The risk to children is now shown to be too great for me to take any other course ..."

This bombshell (although it does not finally settle the scientific question of proof) has certainly shortened the odds in favour of the campaign — which must of necessity be brief and fierce in order to succeed.

An informed source within the oil industry has indicated that, given a reduction in octane number, some oil companies would very much like to take lead out of petrol altogether. However, Government would have to take the initiative, requiring motor manufacturers to supply cars for the UK market which would run efficiently on lead-free petrol. This view was reinforced in a letter to *The Times,* 10 February, by Douglas Harvey, Director General of the UK Petroleum Industry Association Ltd., who pointed out that Government had considered last year the introduction of 92 octane petrol to which the car population could progressively switch. "The oil industry made clear its willingness to accept this and it would be quite untrue to suggest that we sought to prevent it. However, we recognise that such a step would have widespread implications for the motor industry, for energy conservation and for the EEC commitments which only Government could assess."

Since Government decided on the alternative course of a reduction in lead level to 0.15 g/l, the oil industry has to work towards implementing this, at an investment cost of £200m. Should Government at a later stage reverse this decision and choose (for whatever reasons) the lead-free option, the oil industry might have incurred considerable expenditure to no purpose. It was surprising, therefore, that when the Prime Minister was questioned (PMs Questions, 9.2.82) about the Yellowlees letter, neither Michael Foot nor David Steel pressed for early consultation between UK Government and motor manufacturers and their European counterparts on the prospects for eliminating lead from petrol. Without prior commitment at EEC level, unilateral action by the UK would be difficult: motor manufacturing is carried out on a European basis, and the EC Directive specifies a *minimum* petrol lead content of 0.15 g/l. In any event, a total changeover to lead-free petrol would take some years to accomplish. Any change in the whole fleet of cars on the road would have to be paced in order to protect those who have recently bought new cars, and those buying and selling on the secondhand market.

Meanwhile, the CLEAR campaign has been given a boost by the publication of the results of a MORI poll which revealed widespread concern about the potential health hazards of lead in petrol. 46% of those polled believed it to be a "very serious hazard", 33% "a fairly serious hazard" while 12% thought it "only a slight hazard". 89% of the respondents to the survey considered that measures to ban the use of lead in petrol were necessary.

Since the campaign was launched, five other national organisations have joined the original eight backing CLEAR, and the number of supporting MPs has swelled to over 170. The campaign's objectives are being pursued in the Upper House under the leadership of Lady Jane Ewart-Biggs, with 50 peers pledging support. CLEAR has also launched a Europe-wide campaign, and already has a resolution, calling for an EEC lead-free petrol committment, before the European Parliament. The resolution was tabled by Stanley Johnson, MEP, and is now being considered by the Environment Committee.

In May (10 - 12) the CLEAR Trust is holding an International Symposium on 'Low-level lead exposure and its effects on human beings', which will be chaired by Professor Michael Rutter, a member of the DHSS Working Party on Lead, to which he submitted his own review of evidence on the subject. Among the speakers lined up for the Symposium are Dr. Clair Patterson of the California Institute of Technology, Drs. David, Needleman and Winneke (who all spoke at a CALIP symposium in 1979) and Drs. Yule and Lansdown. Details from Susan Dibb, Secretary, CLEAR Trust, 2 Northdown Street, London N1 9BG, tel: 01-278 9686, or through Reader Enquiry Service No. **825.**

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SMOKE CONTROL

The Department of the Environment has written to all local authorities who submitted programmes for 1982/83 notifying them of their allocations. All programmes submitted have been approved in full and the schedule of figures for individual authorities is as follows:

CLEAN AIR ACT 1956
EXCHEQUER CONTRIBUTION TO SMOKE CONTROL ORDERS 1982/83

Region & Local authority	£ Amount*
Northern	
Darlington	19,708
Gateshead	68,740
Hartlepool	6,155
Langbaurgh	69,000
North Tyneside	200,000
South Tyneside	13,433
Stockton-on-Tees	128,000
Yorkshire & Humberside	
Barnsley	200,000
Harrogate	29,008
Kirklees	213,600
Selby	106,399
North West	
Bolton	30,072
Chorley	8,170
Ellesmere Port & Neston	2,000
Liverpool	116,570
Manchester	27,846
Oldham	24,571
Preston	6,143
Rochdale	52,000
St Helens	32,000
South Ribble	13,349
Stockport	22,857
Wigan	100,000
Wirral	74,285

Region & Local Authority	£ Amount *
East Midlands	
Amber Valley	31,040
Ashfield.	28,474
Bassetlaw	11,428
Blaby	4,000
Broxtowe	13,600
Chesterfield	36,864
Derby	74,086
Erewash	13,885
Gedling	4,500
High Peak	20,697
Lincoln	20,000
Newwark	6,000
Nottingham	40,214
Rushcliffe	16,595
South Kesteven	3,008
West Midlands	
Birmingham	92,107
Coventry	57,304
Dudley	28,692
South Staffordshire	9,528
Staffordshire Moorlands	8,890
Stoke-on-Trent	106,344
Walsall	18,115
Warwick	11,565
Wolverhampton	44,000
Worcester	28,000
South West	
Bath	19,002
Bristol	63,936

* Allocations same as LAs programmes for 1982/83

Region & Local Authority	£ Amount *
Eastern	
Peterborough	5,715
South East	
Brighton	18,857
Gravesham	2,100
North Bedfordshire	12,021
Oxford	6,585
Portsmouth	9,000

It has also been decided that one change should be made to the criteria in para 10 ('General approval in principle') of Circular 11/81 (18/81 Welsh office). The average cost per dwelling is now set at a distinct figure for three areas; previously only the Northern Region was differentiated. The change is based on an analysis of the programmes submitted and on orders recently made; it is not a general uprating to account for any increased costs. Both the £200 and £300 figures remain above the typical costs of conversion in their respective areas and only exceptionally expensive orders need be referred to DOE for specific approval in principle. DOE say that there was clearly a substantial group of authorities for whom typical costs fell above the lower limit but well below the upper limit; the intermediate category has been introduced to provide for this group.

New Fireplace Exemption Order

The Smoke Control Areas (Exempted Fireplaces) Order 1981 came into operation on 27 November 1981. This exempts the Rayburn Coalglo C-30, manufactured by Glynwed Domestic and Heating Appliances Limited, from S.11, Clean Air Act 1956: providing that the usual installation, maintenance and operating conditions are complied with so as to minimise smoke emission, and that no fuel other than selected washed coal doubles and trebles (nuts and large nuts) are used.

The Epping Forest District Council (Loughton No. 1) Smoke Control Revocation Order 1981

Epping Forest DC have submitted the above order to the Secretary of State for Confirmation. The effect would be to revoke the 1974 order, which was to have been the first of a series of SCOs in the area, but the District Council have decided against continuing with smoke control and want to tidy things up by scrapping the existing order. Mr. D.O. Westrop, a Loughton resident, wrote to the Society about the Revocation Order saying "The smoke problem in Loughton is far from satisfactory and I find it personally distasteful. I am about to file an objection to the confirmation by the Secretary of State for the Environment of the order."

Epping Forest was identified, in DOE Circular 11/81 Annex F, as being one of the areas where further investigation is needed to determine whether concentrations in excess of one or more the EC Directive limit values are likely to occur.

The Broxbourne (No. 11) Smoke Control Order 1979

On 21st January 1980 the above order was made by the Broxbourne Borough Council. 3 statutory objections having been made to the order, which relates to an area of 2,900 acres, containing 1,899 dwellings and 28 commercial and other premises, a local Public Inquiry was held on 2nd September 1980. The main grounds for objection were that the area was Green Belt land and did not present a smoke problem; that the northern boundary had been badly drawn; that it would increase public expenditure and the demand for oil and gas fuels; and that there was more pollution from motor traffic and horticultural heating plants in the order area.

The area does indeed consist mainly of fields and woodland with some horticultural establishments, but it is residential in the built-up north east districts, adjoining smoke control areas in the London Borough of Enfield, to the south, and existing Broxbourne smokeless areas to the east. The Inspector on the local inquiry toured the area and concluded that a rejection of the whole order would prejudice future consideration of the control of built-up parts. He recommended confirmation of the order, subject to the exclusion of a rural pocket of land. The Department of the Environment considered that as this land bordered existing smoke control areas, its exclusion would interrupt the contiguous and comprehensive coverage of the outer North London and Broxbourne urban areas. The order was therefore confirmed by the Secretary of State, subject only to putting the operative date back still further to 1 July 1982. The letter confirming the order was sent to the Broxbourne BC on 30 September 1981 – one year after the Public Inquiry took place!

OBITUARIES

Dr. Bernard Leadbeater

We deeply regret to inform members of the death, on Thursday January 28th, of Dr. Bernard Leadbeater.

Bernard Leadbeater had a unique approach to the environmental problems which had engaged his mind since 1964, when he became the first full time environmentalist for the Agricultural Division of ICI Limited. At ICI he dealt with all forms of pollution from the Division's activities and coined the term "pollutician" to describe himself. In 1973 he joined Bradford University as a Senior Lecturer in the School of Environmental Science where he continued to research air and water pollution, with a particular interest in odours. He became an individual member of the Society at that time, and his presence as a speaker at various Society functions (most recently at the 1981 Conference in October) always added zest to the proceedings. His enthusiasm and humour illuminated his subject, whether his audience was composed of students or of specialists from industry and local authority. He was particularly generous in sharing his own experience, and in drawing salutory lessons from cases with which he had been involved. He will be very much missed by his friends within the Society, and indeed by all those who came into contact with him.

Mr. H.E.T. Lowbridge

It is with sadness that we have to record that, after a long illness, Bert Lowbridge passed away on 11 December 1981.

Bert Lowbridge had a career spanning nearly 40 years in environmental health, starting as Assistant Sanitary Inspector with the former Willenhall UDC in March 1934. He was appointed as Additional Sanitary Inspector, Stafford BC in 1936, and in 1938 as District Public Health Inspector, Wolverhampton CBC, where he stayed until his appointment in 1947 as Chief Public Health Inspector, Willenhall UDC. In March 1966, he became Deputy Chief Environmental Health Officer to the Walsall MBC which post he held until his retirement in September 1973.

Bert Lowbridge was very closely associated with the Society (he became a member of the Executive Council in 1963) and particularly with the West Midlands Division. He was elected Chairman of the Division in 1974, and was re-elected for another term the following year.

He was very active in other bodies in the Midlands Region, and was Secretary of the Midland Centre Association of Public Health Inspectors 1954-57; Vice-Chairman Midland Centre Council 1958 and Chairman, 1959, 1960, Vice President of the Council 1961/62 and President 1962-64. He was keenly interested in air pollution matters and worked in many capacities to achieve clean air: he was Secretary of the West Midlands Clean Air Campaign Committee 1955-56, a member of the Executive Council and Technical Council of the Midlands Joint Advisory Council on Clean Air and Noise, and Secretary of the Midlands Joint Advisory Councll on Clean Air, 1966.

He was elected Fellow of the Association of Public Health Inspectors 1960.

The funeral took place at Bushbury Crematorium, Wolverhampton, 16th December 1981, and Mrs. K.J. Sulway attended on behalf of the Society and the West Midlands Division; the Division made a donation for Cancer Research as there was a specific request for no flowers.

Bert Lowbridge leaves a widow, Dorothy, a son, Robin and a daughter, Gillian.

'POLLUTION CONTROL' IEHO North West Centre Annual Lancaster Symposium

9 - 11 July 1982, Lancaster University

Topics include: Monitoring, Open Cast Mining, Lead in the Atmosphere, the Internal Environment, Environmental Impact Analysis, Noise Control.

Speakers: Chris Wood, Prof. Peter Lord, Mike Ankers, Rupert Taylor, Neil Turner, Bill Walton, Mike Eastwood.

Details from: Peter Jackson, 15 Wasdale Close, Cockermouth, Cumbria. Tel: Workington (0900) 4351. Reader Enquiry Service No. **826.**

INDUSTRIAL NEWS

Incinco Incinerator to produce heat from waste at Filton

Some £90,000 worth of heat a year will be produced, almost free, by burning much of the rubbish at the Filton site of British Aerospace in a newly commissioned incinerator built by the Incinerator Co. Ltd. The incinerator, plus ancillary equipment, cost over £¼ million to buy and install but the money will be recouped in just 3½ years by savings in oil consumption at current oil prices. Moreover, wastepaper and cardboard may be brought in for burning from other local businesses which would considerably reduce the pay-back period.

Filton is a very large site, with enormous process heat and space heating requirements, currently met by oil-free boilers with total fuel costs running at over £1 million per annum. At the same time, about 50 tons of good combustible waste per week is generated at the complex. Previously, three old incinerators were used to deal chiefly with security documentation, but the arrangement was unsatisfactory on several counts and it was decided in 1979 to have a new incinerator with waste heat recovery. The Incinco design was chosen because of its simplicity, because it was the least labour-intensive and because maintainability was good. Moreover, spares were readily available and much of the maintenance work could be done by British Aerospace themselves.

The installation was designed to supply 8 - 9,000 lbs of steam per hour, which was the base process load, and the necessary waste fuel was available on site. The plant is rated to destroy up to 1000 kilograms of mixed combustible waste per hour comprising cardboard, paper, wood, computer print-outs, clean sawdust and wood chips. In addition, it will handle up to 90 litres per hour of free-flowing mixed combustible waste oil, fired through a waste oil burner set. On the basis of steaming 50-55 hours a week, there will be a 9-10% saving on the total fuel bill at the site, giving a pay-back period of 3½ years. British Aerospace is participating in the Department of Energy's Demonstration Project Scheme, which will mean a 10% grant towards the capital cost of the project, together with 12 months' monitoring by an independent consultant.

Reader Enquiry Service No. **827**

3M Disposable Respirator Approved

Specially developed to give protection against dusts underground, the 3M 8710-S disposable respirator has been approved by the Health and Safety Executive (Mines and Quarries Inspectorate) after laboratory and pit trials.

3M introduced the UK's first disposable filtering facepiece respirator seven years ago.

The 8710-S disposable weighs about a quarter of an ounce and claims to be 90% effective against dusts with a mean particle diameter of 0.4 to 0.6 microns, according to laboratory tests.

The 8710-S respirator is made entirely of the non-woven filter material and is considered an effective alternative to the traditional rubber respirator, long-established but heavy or uncomfortable to wear for a full shift.

Outside the mining industry, according to 3M, its range of 12 'filtering Facepiece' masks and respirators are part of a national trend in modern respiratory protection towards lightweight and disposable products.

Reader Enquiry Service No. **828**

Oil Pollution Control Course

A short course on Oil Pollution Control Technology, arranged jointly by the Institute of Petroleum and Warren Spring Laboratory, will be held May 10-14 1982 at the Copdock Hotel, Near Ipswich.

The purpose of the Course is to provide both practical and theoretical training in Oil Spill Control Technology. Techniques that have been evolved for oil spill clearance will be described and considered so that an appreciation is made of what can be done in the control of pollution.

Each item on the programme will be introduced by a speaker, supplemented where possible by films and group discussion. This will not only present an authoritative view of the topic but will also encourage the development of new ideas that relate to spillages in particular localities. Whenever possible, these topics will be developed by means of demonstrations in the use of materials ashore, on beaches and on board ship.

The lectures will be given by a team of scientists from the Warren Spring Laboratory, led by Mr. Peter Morris, together with support from specialists from the Department of the Environment, Department of Trade, Kent County Council, Ministry of Agriculture, Fisheries and Food, the British Petroleum Co. Ltd. and others.

The course will be managed by the Institute of Petroleum.

Fee: £460 + VAT, to include single accommodation and breakfast at the Copdock Hotel, most meals and Course literature.

Details & Registration: Miss I.A. McCann, Conference Officer, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: 01-636 1004. Telex: 264380.

INDEX TO CLEAN AIR

Vol. 11, Nos. 1 - 4, pages 1 - 156*
(Supplements Index published in Clean Air, Vol. 11, No. 1)
*Page numbers only are cited in this Index

ACID RAIN
European Conference on Acid Rain. Report. *Jane Dunmore.* 69.

ADDRESSES
Address to the 1981 Clean Air Conference. *The Earl of Avon.* 90.
Presidential Address. *Naomi E.S. McIntosh.* 144.

APPOINTMENTS
Institution's (IEHO) President Appointed to Royal Commission on Environmental Pollution. 123.
Manchester Area Council for Clean Air and Noise Control. 94.
New Chief Inspector of Alkali and Clean Air. 102.
New Chief Inspector of Nuclear Installations. 94.

BOOK REVIEWS

Characterisation of Air Quality. BS 6069, Part 1, 1981. 104.
Coal and the Environment. Commission on Energy and the Environment. HMSO, 1981. 93.
The Environmental Health of Worcester 1979 (Noise Control in Worcester). Report of the Chief Environmental Health Officer, Worcester City Council. 23.
Industrial Air Pollution 1979. Annual Report of HM Chief Alkali and Clean Air Inspector. 21.
Solid Smokeless Fuels Federation. Annual Report, 1980/81. 98.
Sound Level Meters. BS 5969. 103.
Threshold Limit Values 1980. Guidance Note EH 15/80. HMSO. 104.

CARBON MONOXIDE

Levels of Carbon Monoxide Experienced Cycling in Central London. *Mark Pyman.* 4.

COAL INDUSTRY

Coal and the Environment – CENE Report. 93.
Coal Study – NSCA Response. 151.
Environmental Problems Associated with Opencasting. *G.R. Millington.* 47.
Environmental Problems Associated with Opencasting – A Selective Review of Practical Considerations. *J. Russell Jackson.* 56.
Presidential Address. *Naomi E.S. McIntosh.* 144.
Public Policy and Private Choice. Editorial. 86.

DIVISIONAL NEWS

EAST MIDLANDS DIVISION – One Day Teach-In on the Environmental Responsibilities of the Local Authority. Report. *E.F. Raven.* 13.
  – Report of AGM, Hinckley. *E.F. Raven.* 97.
  – Report of Meeting at Buxton, 10.9.1981. *E.F. Raven.* 150.
NORTHERN DIVISION – Report of Spring Meeting. *C.R. Cresswell.* 73.
  – Report of AGM, Newcastle upon Tyne, 16.7.1981. *C.R. Cresswell.* 96.
  – Report of Autumn Meeting. *C.R. Cresswell.* 149.
NORTH WEST DIVISION – Announcement of One-Day Symposium. 15.
  – Report of Technical Visit, Capenhurst. *J.B. Douglas.* 74.

EFFECTS OF AIR POLLUTION

Effects of Air Pollution on Materials – An International Debate. *K.G. Saunders.* 117.

FUTURE EVENTS

1981 – Short Courses. 105.
1982 – Forthcoming Conferences and Courses. 156.

INDUSTRIAL NEWS

Advice on how to cope with degraded diesel. 111.
Cadmium in the EEC. 40.
An end to exhaust fume pollution in garage workshops. 114.
Explaining radiological protection: new booklet. 82.
F.E. Beaumont Ltd. 81.
Fluidised Combustion Contractors Ltd. 115.
Government announces consultants for CHP/DH studies. 83.
High efficiency catalytic incineration process – ECONOCAT. 116.
Hybrid systems can halve fuel costs. 81.
Johnson Matthey wins MacRobert award. 39.
New energy conservation teaching pack. 112.
New multi-client project: dust and materials handling. 39.
Portable smokemeter for diesel engines. 113.
Signals to new chimney problems. 38.
SONOMUFF – A quiet revolution. 113.
Teller environmental pollution control test plant available. 115.
Tolltrech lead recycling smelter commissioned in France. 82.
Toxic gas analysers from Analysis Automation. 113.

INTERNATIONAL NEWS

Canada – Air pollution guidelines proposed for thermal power stations. 100.
IUAPPA – Vth Clean Air Congress papers (UK) published. 12.
– VIth World Congress on Air Quality. Announcement. 101.
The Netherlands – Noise control in The Netherlands. *J. Kuiper.* 25.
New Zealand – New Zealand Clean Air Society Inc. 1980/81 Report. 99.
Sweden – European Conference on Acid Rain. Report. 69.
USA – Pollution control under the Reagan administration. 68.

LEAD

Guidance on control of lead at work regulations published. 89.
Measurements of Environmental Lead – the Problem of Representative Sampling. *M.J. Duggan.* 87.
Reduction in the Lead Content of Petrol. 76.

LEGISLATION

New regulations proposed to extend hearing protection to everyone at work. 106.
Noise in The Netherlands. *J. Kuiper.* 25.
Recent Progress in Smoke Control – A Review. *Jane Dunmore.* 30.
Reduction in Lead Content of Petrol. 76.

LETTERS TO THE EDITOR

Diesel fuel quality. 154.
TLV – STEL. 155.

MONITORING

Assessment of Nuisance from Deposited Particulates Using a Simple and Inexpensive Measuring System. *A.L. Beaman and R.W.S.M. Kingsbury.* 77.
Levels of Carbon Monoxide Experienced Cycling in Central London. *Mark Pyman.* 4.
Measurements of Environmental Lead – the Problem of Representative Sampling. *M.J. Duggan.* 87.
Report on the 1981 NSCA Monitoring Workshop. 74.

NOISE

New regulations proposed to extend hearing protection to everyone at work. 106.
Noise Control in Worcester. 23.
Noise in The Netherlands. *J. Kuiper.* 25.
Noise Watchdog Scrapped. Editorial. 2.
Sound Level Meters. 103.

OBITUARIES

Commander Colin Buist, CVO. 84.
Dr. Gordon Nonhebel. 12.

SMOKE CONTROL

The Bracknell No. 7 & No. 8 Smoke Control (Revocation) Orders. 84.
Establishment of Smoke Control Areas. 84.
Pilot's Licence. *John Langston.* 95.
Recent Progress in Smoke Control – A Review. *J. Dunmore.* 30.
Smokeless Home Development – By Area. 67.

SOCIETY NEWS

NSCA Poster Competition – Announcement. 14.
– Awards. 152.
Pilot's Licence. 95.
Report on 1981 Monitoring Workshop. 74.
1981 NSCA Conference – Report. 119.

SOCIETY VIEWS

CENE Coal Study – NSCA Response. 151.
NSCA Views on Abercwmboi, Armitage and the Alkali Inspectorate. 16.

STATISTICS

New Smoke Control Orders. *As at 30.9.1980.* 33. *As at 31.12.1980.* 35.
Smokeless Home Development – by Area. 67.

WOODBURNING AND MULTIFUEL STOVES

103.

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On shivery nights it's so nice to come home to a Coalite fire. Coalite lights easily, burns beautifully with no smoke, soot or sparks. No wonder more and more people are turning to the open fire–and to Coalite.

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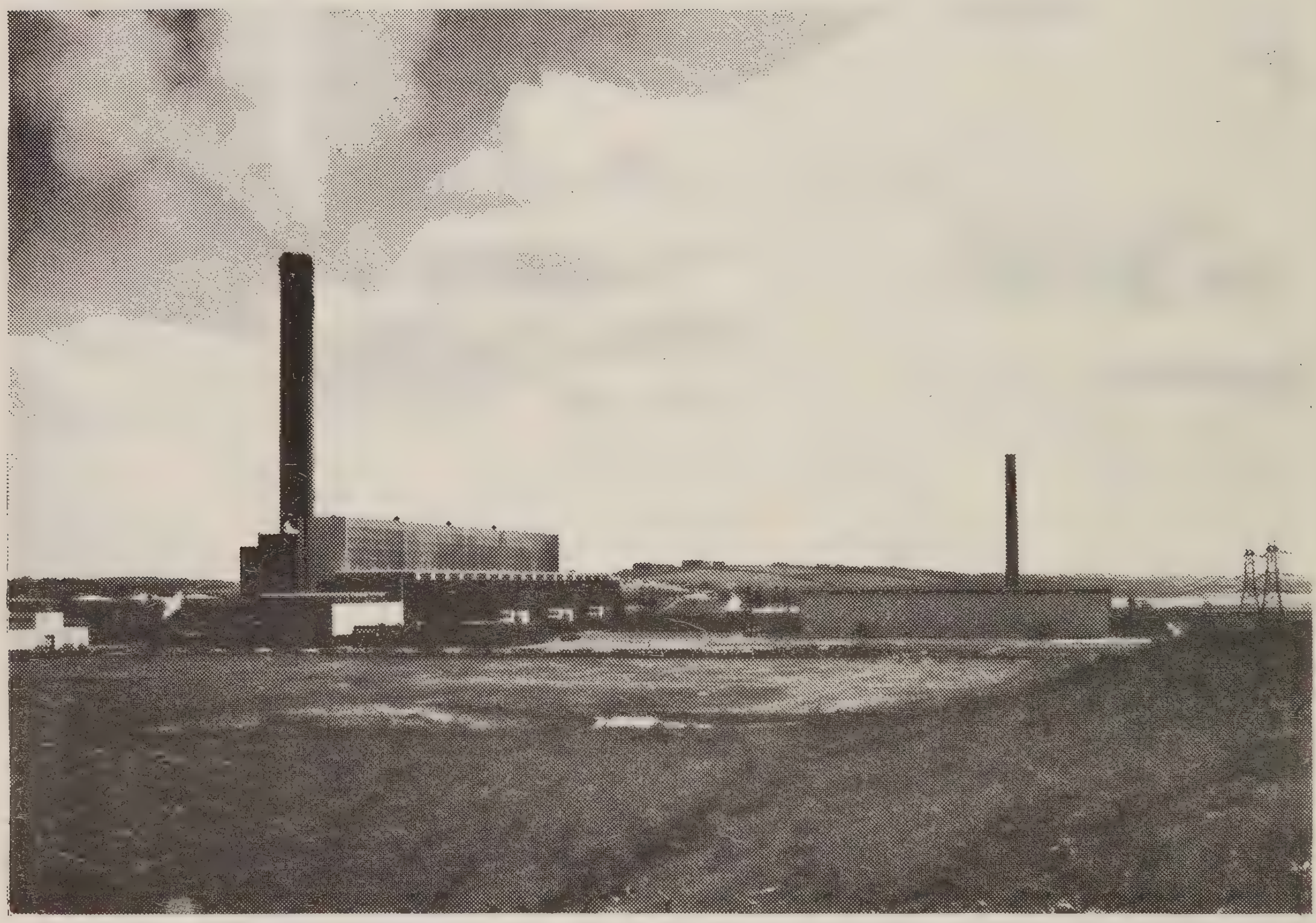
Reader Enquiry Service No. **829**

Caring for the environment



The Central Electricity Generating Board has received more than 40 Commendations and Awards for environmental schemes at power stations, substations and associated nature trails and field study centres in England and Wales.
They include the Arnold Marsh Clean Air Award, two Prince of Wales Awards, four from the Business and Industry Panel for the Environment, six RICS/Times Conservation Awards and nine Wales in Bloom Awards.

Central Electricity Generating Board

Reader Enquiry Service No. 8210

CLEAN AIR

VOL. 12 NO. 2

Middlesex Polytechnic

Pollution Control Courses

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One day and evening a week for four terms

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Write or telephone for full details of either course: **Admissions Office, (Ref C644A), Middlesex Polytechnic, 114 Chase Side, London N14 5PN. 01-886 6599 (24 hours).**

Reader Enquiry Service No. **8211**

NATIONAL SOCIETY FOR CLEAN AIR
49th ANNUAL CONFERENCE
LLANDUDNO
18 – 21 OCTOBER 1982

Subjects will include – Use of Coal by Industry, Domestic Heating, Noise Abatement Zones, Neighbourhood Noise, Noise from Road Vehicles, Control of Construction Site Noise, Air Pollution Related Health Risks, Pollution in Buildings and Underground Facilities, Corrosion by Atmospheric Pollution on Materials, Atmospheric Pollution from the Agricultural and Quarrying Industries

Keynote Address to be given by Lord Flowers, FRS

Conference Brochure available from NSCA at
136 NORTH STREET – BRIGHTON BN1 1RG
Telephone: Brighton (0273) 26313

Reader Enquiry Service No. **8212**

CLEAN AIR

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Contents

Report on 1982 NSCA Workshop 43
Glasgow Clears the Air 48
Smoke from Diesel Vehicles — Is it time for a mass-based emission standard?
David J. Ball 49
NSCA Evidence to the Royal Commission on Environmental Pollution 53
Divisional News 62
Low Level Lead Exposure and its Effects on Human Beings — Symposium Report
Jane Dunmore 63
Bus Burning — Dark Smoke at Night 68
Role of the Environmental Health Officer in Vibration and Noise Control on Building and Heavy Industrial Projects
Alan Henderson 70
Environmental Pollution and Industrial Change in the West Midlands — Seminar Report
Trevor Townsend 82
UK Pollution Research Cuts Attacked at UNEP Hearing 85
Industrial News 86

Index to Advertisers

Central Electricity Generating Board	cvr. iv
Coalite Group Limited	cvr. iii
Middlesex Polytechnic — Pollution Control Courses	cvr. ii

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ROADSIDE MONITORING OF SMOKE AND SO_2

Recent monitoring by the Greater London Council suggests that air quality in some urban streets subject to heavy diesel traffic could be outside the limit values permitted by the EC Directive on Smoke and Sulphur Dioxide. While it is unlikely that diesel smoke concentrations on their own would be sufficient to exceed the limit values they could cause compliance problems when considered in combination with ambient SO_2 concentrations. This would require more stringent emission control of either SO_2 or diesel smoke. Under the terms of the Directive, monitoring is mandatory in all areas where the limit values are **likely** to be approached or exceeded and reports are to be rendered to the Commission of the European Community on monitoring and control measures in areas exceeding the limit values. Since the National Survey is neither designed nor able to provide the necessary data of pollution levels in traffic areas, this Society urges local authorities to monitor urban situations where there could be significant additional exposure of population and environment to vehicle emissions. In the absence of published data by the Government on roadside pollution levels this information would be used to confirm the extent of the problem and to assess the requirement for further control measures.

David Ball's paper (page 49) expands on the problem of smoke emissions from diesel vehicles and suggests that a desirable alternative approach to the control of diesel smoke would be to concentrate on limiting the mass emission rate.

This issue also contains a major and comprehensive review of Society policy on a range of issues, in the form of the Society's submission of evidence to the Royal Commission on Environmental Pollution. *Inter alia,* the NSCA is concerned that the Royal Commission should reinforce some of the recommendations made in its earlier (5th) Report, and take up some of the points arising from the Coal Study carried out by the now enforcedly dormant Commission on Energy and the Environment.

REPORT ON THE 1982 NSCA WORKSHOP

Nottingham University, March 24 & 25

INDUSTRIAL AIR POLLUTION LOCAL PROBLEMS AND NATIONAL POLICIES

The NSCA 1982 workshop, held at Lincoln Hall, offered a unique opportunity to discuss local problems of industrial air pollution in the context of National and International control strategies. The audience was drawn from local authority, industry, research organisations and central government — which insured a broad input into the discussion on the success or otherwise of present controls in the U.K., and possible alternative policies. Among the invited speakers were three from abroad: Dr. Grefen of the VDI Kommission Reinhaltung der Luft, Mr. Hubert Meiners of the Institute for European Environmental Policy (Bonn), who discussed pollution problems and controls in the Netherlands, and Mr. Arnold Price of the EEC Directorate-General for the Environment, Consumer Protection and Nuclear Safety. Thus, U.K. requirements and practice could be measured against approaches in other European countries and the Environmental Policies of the EEC.

Mr. A.J. Clarke, Immediate Past Chairman of the Society, acted as Moderator of the proceedings and conducted the flow of the discussions. The first three papers presented concentrated on the UK scene, taking three different viewpoints. Trevor Townsend, of Wolverhampton MBC, gave a lively presentation which effectively argued the case for local control, particularly of smelting and other industries prevalent in the West Midlands area. He saw the role of Local Authority progressively expanding, enhanced by the greater expertise of their officers and technical staff and by improvements in equipment and administrative structure. He illustrated his talk with various examples of failures in maintenance etc., within industry, which regular inspection by the local authority staff had effectively controlled. He argued the case for greater local authority control of processes which they well understood and for changes in legislation to permit local authority participation in the control of all industrial emissions. This would require, he said, changes in legislation to permit prior consent or registration of all potential air polluting processes. Mike Cabot of HM Alkali and Clean Air Inspectorate reviewed the control of problem industrial air pollution which is firmly established in the U.K. along the best practicable means approach. His case was that the definition of BPM and consequent inspection and enforcement should be the responsibility of one technically competent National Authority in order to be truly effective. Central to his case was a review of progress in tightening controls in two areas — within the cement industry, and the steel industry. However, admitting that there may be a need for a more flexible approach to the allocation of responsibilities between Central and Local Authorities, he discussed the control system in New Zealand which he felt would satisfy many of the recommendations made by the RCEP in their fifth report.

John Fletcher, Site Environment Manager of ICI, Billingham, felt that the term "Industrial Air Pollution" could not refer to observable effects on health, for example, but to the contribution industrial emissions made to ambient levels and about the effect of those emissions on amenity. While his talk indicated an appreciation of the role played by Local Authorities within their present area of responsibility, he argued that industries such as his own required a good working relationship with one central body, which was capable of both setting the control standards and enforcing them. However, wherever the industry is sited, it is part of the local community and he emphasised that good working relationships between industry and the community are helpful in the mutual understanding of environmental concerns. His argument for a consistency of approach which could best be achieved by Central Government controls over "problem" industry was supported by some of the local authority delegates present. But there are day to day difficulties which arise and produce local complaints about smell or dust etc, and in such circumstances local authority delegates agreed with Trevor Townsend that they should have the right to go into the plant and investigate the problem, working closely with the Alkali Inspector in the process.

Representatives from Industry and HM Alkali Clean Air Inspectorate pointed out that Local Authority Officers had access to premises over which they had no regular statutory control and that in some areas industry, ACAI and local authority enjoyed good relationships, with regular meetings to discuss common problems. During the course of the discussion, it emerged that for every example of such a good working relationship, another example could be produced to show inadequacies in the present system; in the end the result was a goalless draw.

The next session dealt with the planning process and access to information on emissions. The restrictions on access to information about industrial emissions have come under considerable criticism in the past. The 1974 Control of Pollution Act provided for a significant addition to the information that may be collected and made known to the public, but so far the legislation seems to have changed things very little. Dr. Graham Bennett of the Catholic University, Nijmegen, Holland, made a study of local liaison committees on pollution in the UK, and his research suggests that such committees fail to come to terms with the key problem in the access to information issue – that of giving the general public the information it specifically wanted, and that they create dilemmas within the control agencies which actually impairs the progress of control. This last finding was particularly controversial and was hotly disputed by Chris Penn of Coventry who has had considerable first hand experience with the pollution prevention panel in that city. Dr. Bennett felt that if, within the framework of a liaison committee, a local authority officer learnt something about an industry's emissions which would normally lead him to take enforcement action, the restraints imposed by confidence could lead to undue delay before action to protect the health of the community was finally taken.

Since the Control of Pollution Act Section 79 provided for Local Authority to obtain information on industrial emissions, remarkably little use has been made of this power. This, it emerged, could be because local authorities feel hampered by the need to protect trade secrets in certain vulnerable industries, and by the belief that they could only obtain information already available to HM Alkali Clean Air Inspectorate. Mike Tunnicliffe, Deputy Chief Inspector, pointed out that local authorities could obtain information "of a type" that is required by the Alkali Inspectorate, not the information that was actually available and already on the file. The other potential difficulty raised was what the public would do with the information once they had obtained it. In particular, whether the public would be able to interpret the information in a meaningful way. David Bird, of Sheffield City Council, believed that most people were capable of interpreting such data for themselves; otherwise, it was the job of the authorities to put the information across sensibly.

Mike Tunnicliffe thought that the National Society for Clean Air should consider conducting a survey of how many information - collecting - and - disemminating committees are in operation and what kind of information they are obtaining and publishing under the provisions of Part IV of the Control of Pollution Act.

Christopher Wood, of Manchester University, gave a fascinating series of case studies on successful and unsuccessful use of planning controls to prevent or alleviate air pollution, and of the response of the community in each case. He pointed out that planning decisions by their very nature have a definite effect on pollution and that the location of industry within a community of whatever type and however serious the potential emissions arising from the process, was a legitimate and proper planning concern. Originally, the planning acts were not designed to control pollution, and local authorities have been warned in the past not to use planning powers to control emissions when other legislation existed which should more properly be used. However, Mr. Wood felt that there were circumstances in which BPM or other locally applied Clean Air legislation could not ensure that industry would be a good neighbour, and that where the existing pollution control legislation or regulations were insufficient, it was proper for planners to use their powers to reject a particular development in a sensitive location. He also felt it was quite acceptable for public inquiries to consider the use of planning powers to prevent undue pollution problems. Planning powers could provide the only "anticipatory" controls available at the time, although planning legislation itself fell down in relation to changes in industrial use of premises (Use Classes Order 1972): one example he gave was of a rug manufacturer who switched to manufacturing herbicides without planning permission being required, with resultant damage to trees and shrubs in the vicinity.

Intensification of use was another area where planning legislation needed to be tightened up. Another interesting point arose in connection with enterprise zones and Mr. P.M. Wright of Salford MBC was able to comment on his experience of producing a pollution control document for an enterprise zone in Salford. Although the Environmental Health Department had tried to anticipate the problems that would arise and lay down their own requirements, they had been informed by DoE that they were usurping a planning control function and that they could only make recommendations, rather than specify controls. Mike Gittins, of Leeds City Council, felt that the Department of the Environment could do more to help Local Authorities in terms of giving specific and regularly updated guidance on air pollution and noise matters.

On Thursday morning Dr. Klaus Grefen from West Germany took delegates through a conducted tour of the Federal German Republics Strategy for air pollution control. The VDI Kommission Reinhaltung der Luft, which he represents, is a non-governmental body of professional engineers who play an active part in the standards-setting process, drawing up guidelines on standards of emission and technical control. There are extensive statutory and technical regulations in the Federal Republic to solve environmental control problems and while the legislative work largely lies with the Federal Government, the implementation and the enforcement of the laws are the responsibility of the eleven Federal States. The enforcement system often differs greatly from state to state and statutory regulations are frequently imprecise.

Dipl. Ing. Hubert Meiners discussed the problems of Air Pollution in the Netherlands in relation to the recent change in the pattern of fuel use, from clean natural gas to coal. This switch has led to raised SO2 levels, in excess of the limits advised by the Netherlands Health Council. However, he emphasised that the Netherlands could not solve its problems by unilateral action. Pollution imported from other countries adds to the indigenous levels and he said that control at international level is required to reduce emissions and prevent long range transport of air pollutants.

Both presentations were valuable inputs to the proceedings, enabling delegates to compare the British system with those of other European countries. While each country's system may have its flaws, the ability to distinguish the good aspect of one system and apply them to another was considered an advantage.

The final business of the workshop was a discussion, led by a panel of speakers, on inputs to legislation at EEC and UK level. The debate centred on whether local authorities and industry have sufficient say in formulating the legislation, with adequate lines of communication to ensure that their views are considered at the right time. The panel speakers — Lionel Rutterford, DOE, Richard Marsh, CBI, Arnold Price, EEC and Mike Gittins, Leeds City Council, each gave their own angle on the subject in ten minutes of comment before the discussion was thrown open to speakers from the floor. Mr. Rutterford, who recently replaced Les Reed as Head of the Air/Noise division within DOE, considered that the DOE's consultation system worked well in practice and that his staff worked particularly hard in maintaining contact with those in industry and local authority. There were however, he felt, problems in involving LAs or industry directly in discussions at EEC level. Arnold Price explained the formal consultative process that operated throughout the preparation of EEC Directives. His view was that local authorities and industry had sufficient say, as long as they took the opportunity to use the various lines of communication available and to put their views to those organisations that act as an input to the Commission's considerations. However, organisations and individuals could not expect to be given preferential treatment and certainly his own sparely staffed section could not cope with a stream of people knocking on the door to put their views direct.

Richard Marsh agreed with Mr. Price that the output in terms of notice being paid to represented views was proportional to the input that various organisations were prepared to make to discussions either within the UK or at EEC level. He felt there was greater scope for the Commission to involve experts within industry at the initial stage of discussions on European legislative policies. He advocated the adoption of a "green paper" approach within the EEC so that proposals would receive an adequate external prior analysis and consideration could be given to the range of alternatives available rather than to a specific draft for a directive which was already set on a particular course. He did not feel that industry had much to complain about with regard to the UK consultation process. Industry as represented by the CBI had both formal and informal routes to communicate their views to Government and were on the whole satisfied with the process.

Mike Gittins felt that the position of environmental health officers and local authorities was far less satisfactory. He showed that there are five routes within the UK system which allow local authority involvement in consultation processes: Royal Commissions, expert committees, consultation within individual expert bodies, in response to lobbying by pressure groups, and private legislation. He felt that however good the examination of the problem undertaken by Commissions or expert bodies, the whole process of consultation in which local authorities have played an active part could be rendered meaningless by Government inaction on recommendations or proposals for legislation. In fact, local authorities really had to take the initiative themselves and act through private legislation which seemed to him the most effective means available to Local Government and the only area in which local interest appeared to use the desired results. In the wide-ranging discussion which followed, it emerged that, while a few local authorities already made a considerable contribution to policy discussions within the EEC, most local authority delegates supported the views expressed by Mike Gittins, and earlier by Trevor Townsend, that there was scope for greater local authority participation in the formulation and enforcement of control standards for industrial emissions to atmosphere.

Workshop Proceedings (papers and discussions) are available from the Society at £6.95 (incl. post & packing). Individual papers are 75p each.

TELESMOKES WANTED

The National Society for Clean Air possesses one Telesmoke — the pocket telescope for checking the density of smoke under the Clean Air Act. This instrument is available on loan to members of the Society, but several local authorities have expressed a wish for a Telesmoke of their own, to have and to hold. Mr. Bennett, of Banff and Buchan DC, Environmental Health Department, is particularly anxious to purchase a Telesmoke. The problem is that the original manufacturers, W. Ottway and Sons Ltd. of Ealing, cannot be traced, nor can Londesborough Instruments Ltd. of Birmingham, who made a similar instrument.

Does any local authority possess a Telesmoke that it wishes to sell? If so, please contact Jane Dunmore at the NSCA's Brighton Office (Tel: 0273 26313). And if anyone has current information on manufacturer(s)/supplier(s) of Telesmokes, please inform the NSCA.

GLASGOW CLEARS THE AIR

Pollution is no longer a dirty word in Glasgow. Today Glaswegians can boast that they live in one of the cleanest industrial cities in the United Kingdom.

The war against grime has been waged since October 15, 1959, when the first Smoke Control Order to affect the city centre came into operation. Since then 40 areas have been created and today 78 per cent of the city is smokeless. The result is an environmental triumph for the District Council who have made Glasgow a much cleaner, healthier and more colourful place in which to live and work. The evidence is all around. The air is fresh, flowers and plants once strangled by filth abound in glorious technicolour, stone-cleaning of beautiful buildings is lasting, the songbirds have returned and even the people wear brighter clothes.

The level of smoke in the atmosphere, which is regularly monitored by the city's Environmental Health Department, has declined from 5,343 ug/m^3 in 1961, to 229 ug/m^3 today. The level of sulphur dioxide was 2,693 ug/m^3, compared with the present figure of 226. (All figures quoted are peak levels.)

Before the Clean Air Act of 1956, every person in the city was breathing in a staggering 30 ozs of soot each year. This had a serious affect on their lungs and respiratory system with bronchitis among city dwellers a common complaint. It also took its toll on buildings. The sulphur oxides in the atmosphere eroded alkaline stones used in many famous buildings, and led to erosion of concrete and cement.

Younger people in Glasgow today do not remember the thick black smogs or "peasoupers" that used to envelope the city. These were killers which claimed the lives of many city dwellers.

Mr. Jim Jackson, Director of Environmental Health, said: "Much progress has been achieved in Glasgow by the encouragement and forward thinking of the former Corporation and now the city of Glasgow district council, in tackling the problem since the Clean Air Act was introduced. We now have 237,402 houses under smoke control orders. That covers 78 per cent of the city and includes industry. This has been achieved only because we have a local authority with the foresight and determination to push this through". Mr. Jackson hopes that the whole programme can be completed by 1986.

Glasgow has its own "Mr Clean Air". He is Ian MacPherson, Air Pollution Divisional Officer. When the city becomes totally smokeless Ian will have completed the job he started in 1959. Ian joked: "I am the only person in the City Chambers who is rapidly working himself out of a job. However, my work is very satisfying. From the top of the building I can look over the city and see what has been achieved. The atmosphere over Glasgow was so dirty at one time that people couldn't see its potential as a major tourist attraction. Now tourists and visitors describe it as a beautiful city. We have everything to offer, architecture, theatres, hotels, shops and a night life that compares with any other city. Looking at other major industrial cities in the country Glasgow is now as good, if not better, than most".

SMOKE FROM DIESEL VEHICLES – IS IT TIME FOR A MASS-BASED EMISSION STANDARD?

by

David J. Ball

Environmental Sciences Division, Scientific Branch
Greater London Council, County Hall, London SE1 7PB

INTRODUCTION

Smoke emissions by diesel-engined road vehicles have long been a source of annoyance to the public. Sir Hugh Beaver drew attention to the nuisance as long ago as 1954 (1). L.E. Reed, now Chief Alkali Inspector, identified diesel smoke emissions as causing 'the loudest outcry' from the British public in the mid-1960's (2), and surveys of public opinion published recently by the DoE (3, 4) are consistent with this view being maintained into the late 1970's. Nor, with exhaust emissions still on the increase (5), is there any reason to suppose that the nuisance has since diminished, though it may (temporarily) have been eclipsed in the minds of the public by the lead-in-petrol debate.

In recognition of the widespread public dissatisfaction over smoke emissions from diesel vehicles, a British Standard was promulgated in 1971 setting maximum smoke emission limits for diesel engines on the production line (6). However, it appears that the effect, intentional or otherwise, may have been more to contain the problem than to solve it. Public concern has not obviously diminished, perhaps because, as has been suggested (7), the standard erred on the side of leniency, especially as no allowance was made for the inevitable in-use deterioration of engines. Various bodies including, notably, the NSCA have since made representations to central government for a stricter standard but none has been forthcoming. Instead, the Department of Transport seems to have been working towards more rigorous enforcement of the standard for vehicles on the road (8). To this end a technical working party was established to report on a quantitative method of checking for compliance at the roadside (9), which would replace the existing, unsatisfactory, qualitative assessment.

In the interim the European Community has adopted more or less the same diesel smoke emission standard in Directive 72/306/EEC, as in the British Standard. It has also adopted air quality limit and guide values for smoke and sulphur dioxide for the protection of health and the environment in Directive 80/779/EEC. Since both Directives encompass smoke, the question is immediately raised as to the compatibility of the emission and limit values. It has been known for several years that emissions of dark smoke by motor vehicles may contribute significantly to ambient concentrations in urban areas, even at sites remote from traffic (10). In near-street locations the population and environment will be exposed to higher concentrations of vehicle-generated smoke and, particularly in these situations, the air quality may fail to comply with the limit values. Surprisingly, although motor vehicles are now a major source of air pollution, few monitoring sites are operated in the UK with a view to assessing their effect on air quality. For example, the National Survey of air pollution selectively excludes sites close to trafficked streets. As a small step towards rectifying this situation four National Survey — type monitoring sites have been established in London during the last year by the GLC specifically for monitoring smoke and sulphur dioxide concentrations where the public and/or buildings etc are particularly exposed to vehicle emissions. A full year's monitoring has yet to be completed, but data gathered so far point strongly to a failure to comply with the limit values at three of the four sites, as a result of combined smoke and sulphur dioxide concentrations. This contrasts with no failures during 1980/81 at the nearly 100 designated National Survey sites in London.

Thus, in urban situations exposed to a vehicular emissions, air quality is likely to be unsatisfactory, both as a result of failing to comply with the EC air quality limit values for the protection of health and the environment, and because it is offensive to the public. Clearly, if the limit values are to be complied with and a more satisfactory air quality achieved, more stringent emission standards and controls will need to be implemented. If the problem were to be tackled by reducing smoke emissions, then attention would focus initially on diesel vehicles as these have by far the highest emission factors on a vehicle-by-vehicle basis and overall probably contribute most to smoke stain measurements of air quality. As will be seen, this requires a fundamental revision of the basis upon which the British Standard, and its European counterpart, were drafted.

THE BASIS OF THE SMOKE EMISSION STANDARDS

The evident dissatisfaction of the public with smoke emissions from diesel vehicles refered to earlier has been recognised by both the motor industry and central government for many years. In 1963, and again in 1971, the Motor Industry Research Association, the Ministry of Transport and Warren Spring Laboratory carried out a series of tests aimed at determining the level of smoke emissions by diesel-engined road vehicles which were acceptable to the general public (11). Diesel vehicles, adjusted to emit various densities of smoke, were driven one at a time past a panel of 48 observers, and each observer asked to rate the vehicle as either acceptable, or unacceptable, in terms of its smoke emission. Subsequently the results of this survey were used to formulate the British Standard on the basis of the smoke emission rate which had been found to be 'acceptable' to 50% of the panel.

While the above study has been found to be beset with a number of technical problems (12), a far more fundamental issue revolves around the underlying premise upon which it is based: namely, that the public are concerned over the visibility of the emissions, or, to quote from the British Standard, 'the light obscuration characteristics'. A recently completed review of public attitudes to environmental disturbance by motor vehicles (12) has failed to find any mention of the visibility of emissions as a cause of concern. What emerges instead is, in the context of air pollution, concern over two other factors. These are perceived health effects, and soiling of property, concern over the latter being widespread to the extent of bothering or annoying one third of the entire population of Britain.

The visibility criterion does not appear compatible with the views of the public, who seem more concerned with ambient smoke concentrations and its effects. If tighter controls are ever to be introduced in order to reduce the level of public dissatisfaction and to meet the EC air quality objectives, the visibility concept will need to be replaced, since this admits no need to control smoke emissions below the point at which they are overtly visible at source.

AN ALTERNATIVE APPROACH TO THE CONTROL OF DIESEL SMOKE

A more relevant approach would be for control to be concerned with limiting the mass emission rate of smoke by diesel engines. This would have several advantages over the present visibility criterion:—

- it would be more relevant in terms of air quality considerations, and hence health and soiling effects
- appropriate emission standards could be computed for the purpose of complying with the air quality limit values
- progressively tighter mass emission standards could be introduced as technology and practicability allowed
- a mass emission standard for smoke would be consistent with the approach for gaseous emissions, already based on mass, and could be expressed in units compatible with those of the air quality limit values.

Also essential is that a system be devised and implemented for the quantitative checking of smoke emissions by vehicles once they have left the production line.

ACKNOWLEDGEMENTS

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COUNCILLOR YELLOWLEY INSTALLED AS LORD MAYOR OF NEWCASTLE

Cllr. Thomas W. Yellowley, MBE, a long standing member of the Society's Council, formerly Chairman and then Vice Chairman of the Society's Northern Division, was installed on 26 May as Lord Mayor of Newcastle upon Tyne. Cllr. Yellowley, who represents the Northern Division on the NSCA's Council, was elected to the Newcastle upon Tyne City Council in May 1963, and has been Chairman of the Health and Environment Committee and a member of the Policy Resources Committee. His keen interest in clean air matters has not only promoted the smoke control success in Newcastle but has been an invaluable asset to the Society, particularly in its Northern Division. We wish both the Lord Mayor and the Lady Mayoress, Mrs. Yellowley, every success and happiness in their year of office.

EVIDENCE FOR THE CONSIDERATION OF THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION

Submitted by the National Society for Clean Air, 1.4.1982.

Matters Outstanding from Earlier Reports

1. *Local/Central Control*

a. In paragraph 159 of their 5th Report, the Royal Commission noted the contrasting views between "the men doing the job" and the evidence submitted by some local authority associations which had urged that the responsibilities of the Alkali Inspectorate should be transferred to local authorities.

b. While we agree totally with the conclusions (in paragraph 160) that the general transfer of the Alkali Inspectorate's control responsibilities to local authorities would be undesirable, we also agree, (vide paragraph 161) that so far as possible there should be local control in matters which cause local concern. As it appears likely that the current political debate about the relationship between central and local government will at some stage impact on this issue, and it is clear that in some areas the relationships between the Alkali Inspectorate and local authorities are still not close enough despite the six years since the publication of the 5th Report, we consider that a significant factor in this has been the complete lack of response to the Report from the Government.

c. Another factor is the absolute division of responsibility imposed by the Government often against the wishes of the officials at local level. A factory fence around a scheduled works can become an equally effective barrier against "local authority interference" where the factory management chooses to make it so. Such divisions in the face of, for example, a public complaint about smell, are against the public interest, and can only be countered by sensible co-operative action between the local authority and the Alkali Inspectorate. However, this haphazard system relies too heavily on the ability of officials, each with their own disparate responsibilities and influences, to form an effective and personal working relationship. And because the legal framework is essentially divisive, there is no real incentive for such a relationship to be established. In the light of this we consider that the proposal (paragraph 225) that local authority environmental health officers should have the right to enter registered premises where they consider a consent may be being breached, would set the framework for an increase in trust and understanding which would afford great public benefit. While such an approach may often be developed by local agreement, we consider it has become imperative for the Government to respond positively to this initiative.

2. *HM Alkali & Clean Air Inspectorate*

a. Noting the recommendation of the 5th Report of the Royal Commission that "the Alkali Inspectorate should be removed from the Health and Safety Executive forthwith and should return to the direct control of the Department of the Environment" – and noting the failure of any Government either to implement or otherwise comment on the recommendation during the more than five years since its publication in January 1976 – and noting various proposals for the reorganisation of the Health and Safety Executive which may be seen in the library of the House of Commons and which include measures affecting the Alkali Inspectorate which would be directly opposed to the above recommendation – the Presidents of the National Society for Clean Air, the Confederation of British Industry, and the Institution of Environmental Health Officers petitioned the Secretary of State for the Environment in the following terms:

> *"We [the undersigned] ask the Government to recognise that the great differences in the nature and scope of the interests of the Alkali and Factory Inspectorates identified by the Royal Commission are basic to any decisions affecting their organisation, and urge the Government to implement the recommendation of the Royal Commission cited above."*

The submission, which was despatched on the 7th July 1981, elicited a reply from the Minister for Local Government and Environmental Services to the effect that the Government was still considering its position on the 5th Report but whatever the decision reached the Secretary of State would ensure that the Inspectorate would continue to be able to discharge adequately his function for controlling air pollution from registered processes.

b. Since then a series of questions in the House of Commons has thrown no further light on the Government's position, nor did a request by the Council of the Society in February 1982 for a meeting with the Minister to discuss the subject produce a positive response. In the light of this and the deep and unanimous concern of our membership that the Government's intentions for the future of HM Alkali and Clean Air Inspectorate may be leading toward the rejection of the conclusions and recommendations put forward by the Royal Commission (in Chapter 8 of its 5th Report) in favour of a solution to the problem based mainly on administrative convenience, we would invite the Royal Commission to address this problem yet again – taking into account any decision by Government which may emerge during the current session of the Royal Commission.

Changes in Approach

3. *Air Pollution Control Through Planning*

a. The traditional role of the air pollution agencies in respect of planning is that of reacting to proposals: seeking either to amend or to oppose them. Attempts to move towards a more positive role have often been frustrated by a realisation of the dangers inherent in an over reliance on simplistic zoning policies. The UK approach to pollution control has however, resulted in a great deal of knowledge and experience about our industrial areas including emission levels, ground level concentrations, the area micro-climate, etc. Structure Plans also provide general zoning policies in land use terms. Thus the Air Pollution Control Agencies have at their disposal the means to provide positive guidance, albeit in very general terms, about what is or is not generally acceptable in a given area, and what the effect of a proposal might be on other parts of the community.

b. In most parts of the UK the highest priority is placed on the attraction of investment and the creation of employment. This is not necessarily compatible with securing lower levels of air pollution. Research has given "bench marks" against which a local air quality may be compared. In respect of smoke and sulphur dioxide the EEC Directive (80/779) on air quality limit values and guide values is relevant.

c. Many local authorities have observed a dramatic fall in ground level pollution concentrations either as a result of their policies in industrial air pollution control, or domestic smoke control, or simply as a result of factory closure. As a result, some see themselves as enjoying in financial terms, a resource allocation of clean air — the term "clean" being definable by reference to the guide and limit values and permitting the introduction of air quality management policies aimed directly at the positive growth of industrial development: the balance between a planned rise in levels of pollution against investment created being a political judgement for determination by local authority elected Members.

d. Bearing in mind the forecast changes in fuel use (paragraph 8 refers), the general undesirability of actually seeking any degradation in air quality and in view of the change in air pollution control permitted by the introduction of the air quality approach embodied in the EEC Directive, this Society invites the Royal Commission to consider the potential consequences for the nation should the practice described in 3c above, become widespread.

Gaps in Knowledge

4. *The Internal Environment.* While there has been considerable progress in the field of environmental pollution, nevertheless significant gaps in knowledge remain. In particular, there has been a tendency in the past to concentrate attention on what might be termed the macro as opposed to the micro level, namely, the internal environment which was deliberately excluded from the Royal Commission's remit in its first report. We consider that further studies are required to assess the risks to health of long-term low-level exposure to air contamination in both the domestic and office accommodation. In the past, monitoring of these areas has generally tended to be at a somewhat basic level and, whilst there has been some movement towards extending studies and the adoption of more sophisticated techniques by authorities with major resources, such progress has largely been halted as a consequence of the recession. In any event, as the scale of populations involved is generally beyond the scope of local organisations, epidemiological studies should be mounted/co-ordinated nationally: inter alia, studies should include the long term effects of occupying sealed, artificially ventilated and conditioned offices (the normal working environment for a significant proportion of the population), where substances such as cleaning materials, type correction fluids, flame retardents, etc. are constantly recirculated.

5. *Roadside Monitoring of Smoke and SO_2.* Recent monitoring by the Greater London Council suggests that air quality in some urban streets subject to heavy diesel traffic could

be outside the limit values permitted by the EC Directive on Smoke and Sulphur Dioxide. While it is unlikely that diesel smoke concentrations on their own would be sufficient to exceed the limit values, they could cause compliance problems when considered in combination with ambient SO_2 concentrations. This would require more stringent emission control of either SO_2 or diesel smoke. Under the terms of the Directive, monitoring is mandatory in all areas where the limit values are likely to be approached or exceeded, and reports are to be rendered to the Commission of the European Community on Monitoring and control measures in areas exceeding the limit values. Since the National Survey is neither designed nor able to provide the necessary data on pollution levels in traffic areas, we consider that local authorities should monitor urban situations where there could be significant additional exposure of population and environment to vehicle emissions — both to confirm the extent of the problem and to assess the requirement for further control measures.

6. *Lead in the Environment*

a. The Society considers that the continuing conflict of expert opinion on the health effects of low body lead levels is such that the evidence of substantial damage to children remains persuasive rather than conclusive. In addition there is still doubt about the contribution to body lead levels arising from lead in car exhausts as distinct from other sources. Nevertheless, we consider that the possibility of significant damage is sufficient to justify the public demand for the elimination of lead in petrol and propose measures to this end in paragraph 7 below. However, whilst this reflects the Society's primary concern for the achievement of clean air, we note that airborne emissions, whether directly inhaled or ingested from fall out, provide only one route by which lead reaches the human body. In the light of this we consider that other sources — food, water, soil, pica, cosmetics, utensils — require careful monitoring to ensure that all expenditure related to reducing body lead levels, whether in children or in adults, is optimised.

Primary and Secondary Air Pollution — Especially by Motor Vehicles

7. a. *General.* In its book "Pollution from Road Vehicles" the Society concludes that the motor vehicle as we know it now is likely to be with us for some considerable time to come. While LPG and alcohols may have a limited application, petrol and derv are likely to remain the chief fuels to be used in vehicles propelled by internal combustion engines. It is the Society's view that primary pollutants, and more particularly, smoke and noise from diesel vehicles, are of greatest concern.

b. *Lead in Petrol.* While the Society regards the decision of the Government to reduce further the lead content of petrol as the most practicable means of achieving a welcome reduction in lead emissions, we consider that lead free petrol should be mandatory for all new cars at the earliest opportunity. To this end the permitted lead content of petrol specified in EC Council Directive 78/611/EEC should be amended to eliminate the lower limit. Additionally, the adequacy of the blood-lead standard specified in EC Council Directive 77/312/EEC should be reviewed, while the lead in air standards specified in the proposed EC Council Directive should be reviewed and developed to take account of the contribution of lead in the air to lead in dust levels.

c. *HGV – Diesel Emissions.*

(1) With regard to the Government statement that "heavier vehicles will be required to meet the same standards for pollution as existing 32.5 tonne vehicles and to meet the approved standards the Government is preparing as these come into force "the Society notes that no technical data on emission levels has been provided which would enable a comprehensive assessment of the implications of having heavier lorries on roadside air quality. Moreover, in terms of the existing legislation the statement is open to interpretation.

(2) Total levels of particulates from diesel engined vehicles have been increasing steadily over the past decade and any further increase in smoke quantity must be considered undesirable. However, lack of published data on the effect of diesel emissions and on air quantity measurements taken at the roadside, makes it virtually impossible to judge scientifically the likely impact of the heavier lorries. We consider therefore, that the contribution of lorries and road traffic generally to air pollution levels in towns and cities should be reappraised before any Government commitment is made to a continuation of present standards.

(3) In the light of (1) and (2) above, the Society has already called for stricter smoke emission acceptance testing of all diesel engined vehicles to reduce at the outset the potential for smoke emission. We would therefore, find it unacceptable for a new fleet of heavy lorries meeting *present* standards to be introduced in the United Kingdom. In addition, the Society has called for more checks on smoke emissions from vehicles in use. We believe that public opposition to the current emission levels is greatly influenced by the number of vehicles on the road which are emitting smoke well above the legal limit: as this is indicative of maladjustment or overloading we consider that the Government is placing insufficient weight on the vital need to convince operators that slipshod maintenance or the deliberate misuse of the equipment will be effectively policed.

e. *Private Cars.* The Society notes the trend in Europe towards the dieselisation of the private car. While up to the present time the pricing structure of fuels has tended to resist the trend in the United Kingdom, nevertheless, it is apparent that a change in the relative price of petrol and diesel fuel, which a Government could bring about, would give strong encouragement to the diesel vehicle and be well justified on grounds of energy conservation. The Society would expect that such a trend would aggravate the smoke problem (discussed above) particularly in London, where the diesel buses and taxis are a significant proportion of the total vehicle population. In the light of this we suggest that attention should be given to the potential problem which Government may resist or stimulate by fiscal arrangement. We also anticipate that diesel fuel odour, and noise, would add to the problems of smoke in the event of greater use of diesel engines for private cars.

f. *Secondary Pollutants.*

(1) Secondary pollutants especially relevant to vehicle emissions include oxidants, aldehydes and those polynuclear aromatic hydrocarbons amongst which there may be carcinogens. The first of these, the oxidants, are generally associated with vehicle

emissions of oxides of nitrogen and certain hydrocarbons and the incidence of photochemical smog. In recent years it has become apparent that oxidants, the precursors of the smogs, are being stimulated in some areas by oxides of both nitrogen and sulphur generated at some great distance from the location of the oxidants. In so far as the rare incidents of oxidants in the UK have seemed to be centred in areas remote from city centres, there is the suggestion that long range transport should be as carefully watched as traffic pollution in respect to any undesirable consequence resulting from oxidants. The Society presumes that the attentions of appropriate international conventions of the United Nations and EEC will prevent any difficulties in this respect.

(2) Problems associated with aldehydes are not expected unless there is any considerable use in road vehicles of the alternative fuels such as LPG and oxygenates. The too rapid depletion of UK oil resources would be a major contributory factor. Hence, it is seen that the slow conversion of oil burning to coal burning in industry should be accelerated if problems of this sort are to be avoided.

(3) The Society considers that there is insufficient medical evidence to suggest what action, if any, is necessary with respect to the emissions of polynuclear aromatic hydrocarbons from automotive vehicles. We note that until recently the American attitude has been that carcinogens in any concentrations should be avoided. More recently less extreme views seemed to be gaining medical support. As yet there is no evidence suggesting that airborne polynuclear aromatic hydrocarbons which originate at very low concentration from vehicle emissions are contributors to cancer. Nevertheless, it would be difficult to produce evidence that the effects of vehicle emissions would not contribute in some small part to the illness of the smoker who contracted cancer. The Society suggests, therefore, that the first priority should be given to stopping smoking before undertaking the more difficult, and possibly inconsequential, task of eliminating parts per billion concentrations of carcinogens in combustion products.

Clean Air Legislation

8. *Crown Premises.* Although the Society appreciates the argument that it could be illogical for the Crown to institute proceedings in respect of offences otherwise actionable under the Clean Air Act of 1956 in respect of premises occupied by or on behalf of the Crown or a Government Department, we are concerned at the very large number of premises in which departments apparently continuously use the exemption provisions to flout the spirit of the legislation. In the light of this we recommend that the Royal Commission examines the means whereby Crown Premises would be explicitly required to meet the terms of the legislation.

Future Trends and Potential Problems

9. *Commission on Energy and the Environment: Coal and the Environment*

a. In responding to the invitation by the Department of the Environment for comments on this Report, the Society noted the conclusions of the Commission on the potential increases in the use of coal by industry and in the commercial/public sector by the turn of the century, and its acceptance that this could aggravate the existing air pollution problem involving the increase in particulate emissions leading to greater dirtiness and consequent loss of amenity. The Society considered that energy policy, particularly with regard to coal use, should have clean air as a priority. In this respect industry should be encouraged to take up Government grant where conversion to coal is made, and Government should apportion some of that grant to proper training of stokers and boiler operators so that grit and dust emissions may be minimised. The Society noted also the view of the Commission that although over the same period there is unlikely to be any appreciable change in the amount of coal burned domestically, the further development of smokeless fuel for smoke control in the domestic sector is unlikely to be a viable option and the more favoured approach would be the design and installation of special smoke-reducing appliances. As far as the latter is concerned, the Society has yet to be convinced that the necessary expertise to burn coal smokelessly is to be found in the ordinary household.

b. In the light of the foregoing the Society very much regretted that the Commission had apparently failed to recognise that the effectiveness of the Clean Air Acts as they are being implemented is already in disrepute. There is growing evidence of the widespread use of bituminous coal for domestic heating in smoke control areas, and the report should, therefore have emphasised a basic requirement for the Acts to be enforced as it originally intended as the starting point from which to deal with future increases in domestic and industrial emissions. Moreover, the Society is of the opinion that the report has not gone far enough in considering the practical consequences arising from the ever increasing costs of clean fuels: it is concerned that the report underestimates the potential increase in pollution which could result from the burning of coal domestically unless the Acts are enforced as intended. The Society considers, therefore that the report should have called for a clear statement of intention by the Government for a full programme of smoke control to be progressed throughout the country to be completed by a duly established date.

c. Chapter 19 paragraph 30 of the Report notes the "general unawareness of local authorities and other interested bodies of the possible scale of re-entry of coal into the industrial market, in spite of the projected fourfold increase in industrial coal burn". In view of this the Commission foresaw the need for: a continuing and systematic dialogue between Government, the National Coal Board, industrial associations and local authorities, on the preparatory action necessary to accommodate fuel substitution on the scale envisaged; and, as a parallel measure, considered that it might be necessary for local authorities to be provided with additional powers to prevent excessive pollution from emissions arising from large numbers of existing industrial premises, if they change from oil or gas firing to coal, even though the emissions from such premises are individually within the limits of the Clean Air Acts. In the light of this, the Society would welcome a full examination of the adequacy of the existing powers available to local authorities to anticipate and control this type of situation.

10. *Straw and Stubble Burning*

a. Chiefly in England, in an area ranging from Cheshire to the English Channel and from the East coast to Wales, about 5 million tonnes of straw and possibly 3.4 million hectares of stubble are burned by the farming industry during a 4 - 6 weeks period following the harvest. Air pollution from the smoke and partially burned pieces of straw is often transported over great distances: the extent of the pollution being intensified during anticyclonic conditions. The local authority members of this Society in areas subject to this pollution regularly report it as a matter of widespread complaint from all levels and sections of the community. While both the Ministry of Agriculture, Fisheries and Food and the National Farmers Union acknowledge the public concern over this form of pollution — and seek its control through encouraging the farming industry to burn in accordance with a Code of Practice and for local authorities to introduce Bye-laws enabling the enforcement of certain, albeit limited, measures of control, neither MAFF nor the NFU accepted the point of view that the burning of straw and stubble as now practised has become unacceptable with the balance of argument for preventing its continuation being outweighed by the objections of the citizens.

b. Despite a detailed case received from the National Farmers Union in which it seeks to justify the continuation of the practice of straw and stubble burning, the Society remains unconvinced that the grounds for excusing the farming industry from comparable provisions regulating smoke and particulate emissions as apply to all other industries can be sustained. We note that Bye-laws are ineffective where the air pollution has been transported from another local authority area, and we note that there is no intention by the farming industry to change its existing practices in any substantial way. Nevertheless, the Society considers that without legislative backing and independent enforcement, Codes of Practice, no matter how stringent, will not work. As with all other industries the farming industry should be brought within the law and as necessary conform with the "polluter pays" principle. In this connection, the Society sees a parallel between straw and stubble burning and construction site noise. Under the Control of Pollution Act 1974 the inevitability of noise from construction sites is accepted, but local authorities have powers of prior approval permitting them to enforce a Code of Practice. Similar powers in relation to a strengthened NFU Code and duly enforced might, we feel, substantially ameliorate the problem. We strongly urge, therefore, that the Royal Commission should examine the requirement for new legislation controlling straw and stubble burning.

Noise

11. *Transportation Noise.*

a. Noise from road and rail traffic is a major source of environmental nuisance. The power to introduce or affect these noise nuisances lies with the statutory undertakers and the public authorities, and the legislative framework appears to be more concerned with protection of their rights and interests than those of the general public! There is, in fact, no effective remedy open to a member of the public aggrieved by high levels of railway noise, and the British Rail Board have shown few signs of compassion in that direction.

Nor should the local authorities be in any way smug: the only legislation relating to roads (The Noise Insulation Regulations) are clearly weighted in their favour. Firstly, the Regulations are made under the Land Compensation Act, in which the tone is one of compensating the potential noise sufferer rather than protecting his interest, and is seen therefore, as a limitation placed on the sufferer. Secondly, the compensation level of 68 dbA L_{10} (18 hr) is excesively high for the purpose for which it has become used; a criterion level of the acceptability or otherwise of traffic noise. Thirdly, the Regulations are only concerned with protection of residents inside the house structure and do nothing about gardens and "living spaces". Finally (and the worst indictment of all) the Regulations only apply in the case of a "new" road or a substantially reconstructed road. Where a traffic scheme routes vehicles through what had previously been a quiet urban backwater, the local authority has no powers to assist the householders so affected. This situation can cause untold misery and condemn people to a level of noise nuisance which in other circumstances would undoubtedly have resulted in legal action by the local authority. Thus, the Society considers that there is a strong requirement for reviewing all aspects of the legislation on this subject including a full re-examination of the criteria suggested as long ago as 1963 by the Wilson Committee on noise. The basis of any legislation should be the prevention of exposure to excessive noise levels, however caused. The criterion for prevention or remedial measures should, therefore, be actual noise levels, and not principles which have the aura of compensation payment for inevitable environmental damage caused by public authorities.

Lastly, in noting the substantial and permanent increase in amenity derived from pedestrianisation schemes, we consider that there should be a national policy encouraging their promotion in inner-city areas.

b. *Entertainment Premises.* Noise nuisance from premises, particularly entertainment premises, can at present only be dealt with in relation to the activities within those premises. However, acute problems are often experienced in relation to anti-social behaviour, movements etc. in public places, arising from the use of specific premises. Furthermore, present powers to obtain information regarding ownership of premises or identify persons responsible for nuisance are limited, and it is easy for the unscrupulous to avoid prosecution. We consider that these matters are of sufficient National concern to warrant the consideration of the Royal Commission.

c. *Domestic Noise.* This continues to be a source of considerable friction and although experience shows that the Control of Pollution Act 1974 can be successfully applied, it seems probable that many nuisances remain unreported and unresolved because the local authorities have neither the time nor the manpower to investigate and prosecute. In the light of this we consider that there is scope for a summary offence of "causing or permitting any excessive or unreasonable noise to be emitted from any domestic premises in such volume, or for such periods, as may give reasonable cause for annoyance to any person", subject to suitable safeguards. This could be actionable following a verbal or written complaint from any person failing to secure abatement forthwith.

d. *Noise Assessment Criteria.* As the number of noise assessment criteria appears to be "mushrooming" the Society notes a requirement for the various indices to be codified as much as possible in the search for simple definitive criteria.

e. *Low Frequency Noise.* In the light of recent research into the problems of low frequency noise and a general dearth of knowledge on the subject, the Society recommends that the Royal Commission should examine the nature and extent of the problems associated with low frequency noise with a view to promoting further research.

f. *Vibration.* As the Society regards vibration as a logical extension of noise, it invites the Royal Commission to look at standards relating to assessment and criteria justifying control in view of the present disagreement over the relative merits of displacement, velocity and acceleration as assessment methods and the standards relating to control.

DIVISIONAL NEWS

Northern Division

Thirty eight members of the Northern Division attended a meeting in the Library Building, South Shields on Wednesday, 31st March 1982.

Mr. A.G. Shankster, Principal Environmental Health Officer, Stockton on Tees District Council, gave a talk on 'Public Awareness and Council Activity in a Chemical Industrial Area'. With the help of slides he traced the history of numerous chemical industries on Teesside who had contributed to environmental pollution of the air by the emission of a variety of chemical compounds. To be more aware of the types and concentrations of air pollutants, Stockton Council have fitted out a mobile laboratory with instruments capable of monitoring dust emissions, sulphur dioxide and oxides of nitrogen. Details of the laboratory equipment and results obtained were explained by Mr. Shankster.

Mr. S. Green, Wansbeck D.C., expressed the thanks of the members to the speaker.

C.R. Cresswell
Hon. Secretary

LOW FREQUENCY NOISE PRESENTATION SUCCEEDS IN VIENNA

Hylton Dawson of Rolls Royce Ltd., who had a notable success with his paper on Low Frequency Noise at the last NSCA Conference, was well received when he gave the same paper to the XII AICB Congress in Vienna, April 1982. Mr. Dawson attended the Congress both as an author and on behalf of the NSCA (the Society is an Associate Member of AICB — the International Association Against Noise).

The Congress programme covered a wide range of noise research, but Mr. Dawson's was the only paper on low frequency noise. It evoked a great deal of interest and those present welcomed the fact that the matter had been raised and even more that the NSCA could show that some work had been done on a definitive environmental standard.

LOW LEVEL LEAD EXPOSURE AND ITS EFFECTS ON HUMAN BEINGS

Report on CLEAR Symposium, by **Jane Dunmore**

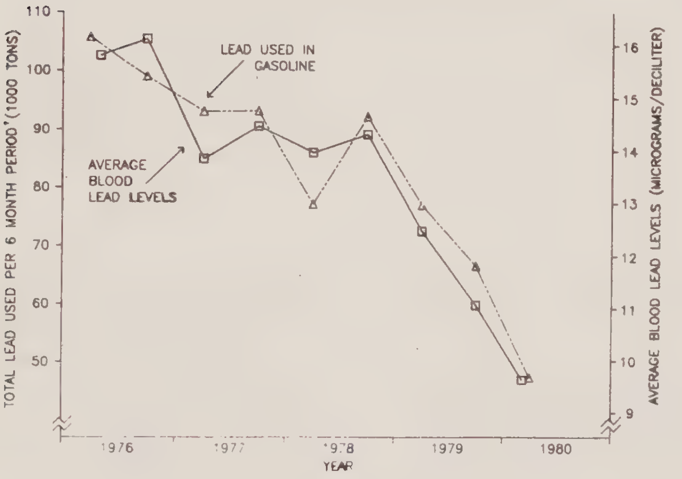
The scientific symposium organised by the CLEAR Trust and held 10-12 May in London began with all the ingredients of success — and only one disadvantage. The elements for success were: generous sponsorship by Pura Foods Ltd, which enabled the organisers to bring together an astonishing array of the leading researchers from the United States, Germany, Denmark, Greece and the UK; an impressive, although not overly impressionable audience of doctors, scientists, and workers in community and environmental health; and an eminent Chairman, Professor Michael Rutter, leading child psychiatrist and a member of the DHSS Working Party on Lead. The disadvantage was timing; the symposium occurred while press and public interest was inevitably focussed on the Falklands' crisis, so that its impact in terms of media coverage was somewhat reduced.

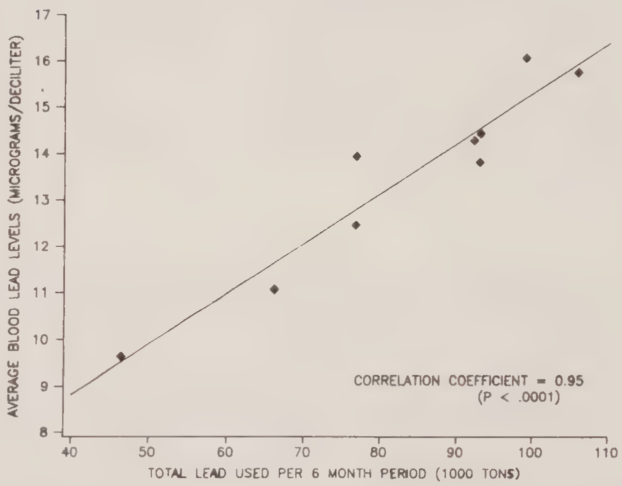
In his opening remarks, Professor Rutter said that the main purpose of the meeting was to allow a critical and thoughtful appraisal of the evidence on low level lead exposure: a "state of the art" review of current knowledge and gaps in knowledge, and an assessment of the implications. Referring to the DHSS (Lawther Committee) Report, he said that the meeting was an opportunity for a fresh look at the evidence on risks to health and above all, for an examination of the findings that had become available in the two years since the Lawther Report was published. What the symposium should not do, he stressed, was to provide a forum for political debate or attacks on personal or scientific integrity (although Prof. Rutter himself dismissed Dr. Bryce-Smith's claim of a causal relationship between lead and last year's riots as "ridiculous" and not warranting serious discussion.) In general, the symposium lived up to the Chairman's hopes. The level of debate was unusually penetrating, largely free from acrimony, and conducted with a respect for, if not always agreement with, others' views.

The empirical research presented by various speakers was mostly new, or up-dated, and involved a wide range of scientific disciplines. The research covered two main areas: first, the contribution of lead in petrol to lead in the environment and lead in the human body; secondly, the effects of low level lead exposure.

Dr. Clair Patterson began the proceedings elegantly by showing that most people living in industrialised societies contain between 500 and 1000 times more lead in their bodies than did their prehistoric ancestors. However, since all scientific laboratories, experimental animals and tissues, reagents and human subjects are so highly contaminated with lead, there are no natural controls in existence to allow proper comparison studies to be done to determine the ill effects of current levels of lead in the human body.

Data presented by Drs. Annest and Billick showed that there had been a very substantial fall in blood lead levels in the USA in the last few years. Dr. Annest, Geneticist and Statistician at the National Centre for Health Statistics, USA, presented recently published research revealing that blood lead levels in the US fell by 36.7% within four years of the start of a phase-out of lead in petrol. Overall, mean blood lead levels fell from 15.8 *u*g/dl to 10.0 *u*g/dl. Decreases were found in all races, ages and both sexes. Further analysis of the results indicated that the reduction was not due to seasonal sampling, income sampling, geographic region sampling, urban v. rural sampling, laboratory-measurement error, or chance. These results were published as one component of the second National Health and Nutrional Examination Survey (NHANES II).


LEAD USED IN GASOLINE PRODUCTION AND AVERAGE NHANES II BLOOD LEAD LEVELS (FEB. 1976 – FEB. 1980)


AVERAGE NHANES II BLOOD LEAD LEVELS VS. LEAD USED IN GASOLINE PRODUCTION

Reliable blood lead levels taken by venepuncture were determined for blood specimens from a probability sample representative of the US population, aged 6 months to 74 years (9,936 individuals). Individuals were selected for examination and blood lead determinations independent of their risk of exposure to lead or their EP result. Lead concentrations of the sample whole blood specimens, and quality control specimens, were determined by atomic absorption spectrophotometry. Blood lead levels ranged from 2.0 to almost 70 *u*g/dl.

The findings were that for children under 6 years there was no statistically significant correlation between age and mean blood lead levels. For children and youths aged 6 - 17 years there was a statistically significant relationship; in general, the mean blood lead values declined with increasing age until late adolescence. Among adults, the mean blood lead levels were positively associated with age until late middle age, followed by a moderate decline in the older age groups. There was a significant association between race and blood lead concentration, with black children aged 6 months – 5 years having on average 6 *u*g/dl higher blood lead levels than white children. There was no clear cut explanation of this racial difference, but it agreed with findings of Dr. Irwin Billick and others. There were also higher blood levels among black children in the lower income groups, and large urban areas could be distinguished by looking at the percentage of children with blood lead levels of 30 *u*g/dl or more. (30 *u*g/dl is the cut off used in the US community-based lead poisoning prevention programme for referring children for medical attention and follow-up). Overall, an estimated 4%, or approx. 675,000 US children aged 6 months – 5 years showed evidence of excessive or undue absorption of lead. 18.5% of black children from low income families, the group with the highest proportion of elevated blood lead levels, showed evidence of undue lead absorption.

The predicted percentage reduction in blood lead levels, Feb. 1976 – Feb. 1980, was equal to or greater than 30% for all sub-groups, except for whites in large urbanised areas (19.2%). The possible factors in this reduction were: community awareness of the toxicity of lead, lead screening programmes, occupational health and safety, food controls, and the reduction of lead in petrol. While the first four factors could have been significant in some circumstances, the decrease in the weighted mean blood lead levels computed by 6 month intervals for the NHANES II data almost parallel the amount of lead used in the production of petrol in the US from Feb. 1976 – Feb. 1980. The probability of a causal relationship was, said Dr. Annest, .95.

Dr. Annest's evidence is strengthened by the release in this country of the preliminary results of an isotopic lead experiment carried out in the Piedmont region of North West Italy. This large scale non-radioactive tracer experiment involved the use, as an anti-knock compound added to petrol, of a lead from the Australian Broken Hill Mine. This has an isotopic composition (Pb-206/Pb-207=1.04) significantly different from the lead encountered in the environment of the test area (Pb-206/Pb-207=1.18) at the beginning of the project. The primary goal of the project is to determine the fraction of automotive lead in human blood, with subsidiary objectives of determining the pathway of automotive lead through air, vegetation, soil, food, and possibly its distribution in the human body. The preliminary conclusions are that 85% of the lead present in the air of the urban areas of Turin comes from petrol, and that 30% of lead in blood samples also comes from petrol.

Dr. I. Billick, reviewing the sources of lead exposure in the US, emphasised the importance of reducing the serious sources, whichever they were, rather than concentrating on assigning blame to particular sources. Since 1973, there has been heavy Federal investment in screening programmes throughout the US, to identify individuals with elevated blood Pb, and those suffering from lead poisoning. However, although a good correlation might have been expected between child blood Pb levels and painted surfaces, that had not been demonstrated; even where painted surfaces were cracking, there was only a poor correlation. The relationship between blood Pb levels and US petrol consumption was more significant. The difference between urban and rural blood Pb levels was not as great as might have been inferred from this correlation, but Dr. Billick attributed this to a difference in patterns of consumption of petrol: motorists in urban areas tended to purchase new cars, running on lead-free petrol, sooner than country dwellers, and therefore the consumption of lead-free petrol was greater in urban than in rural areas.

Ellen K. Silbergeld, Ph.D, of the Environmental Defence Fund, Washington USA, presented conclusions from experimental animal studies of lead neurotoxicity. While behavioural dysfunction in rodents cannot be compared directly with hyperactivity in children, increased motoric activity has frequently been observed in lead exposed rodents.

Age is a significant factor, although in mice exposed to lead from birth, a persistent hyperactivity is produced which, while reduced with age, still remains higher at all days measured than the activity of age-matched controls. In relation to learnt patterns of behaviour, lead exposed rodents showed particular difficulties in reversing established patterns, and tasks requiring relatively fine visual discrimination have been found to be performed less well by lead exposed rodents, primates and sheep. While these behavioural difficulties were usually related to levels of lead substantially higher than the normal in human populations, Dr. Silbergeld showed that abnormalities in the cerebral cortex and and other body tissues were found in animals that did not show any overt behavioural changes. She also concluded from her studies that the toxic effects of lead persist after cessation of exposure and that chelation (treatment for lead poisoning via the introduction of chemical agents which bind the lead) does not readily remove lead from the brain. Professor Rutter, referring to this important research in his closing remarks, said, "We may conclude that increased levels of body lead can and do cause impairment of biological functioning at levels below those associated with obvious signs and symptoms".

Dr. Oliver David (Dept. of Psychiatry, State University of New York) has studied the effects of chelation on children diagnosed as hyperactive, but with lead levels currently described as "elevated but non toxic". The premise behind the study was that if children with 'low' lead levels were treated to remove the lead, and their condition/behaviour observedly improved, then the lead, even at low levels, must have been exerting a toxic effect. Children were treated with a lead chelating agent in a double blind, random allocation treatment regimen, over a period of 12 weeks. Three independent evaluations of behaviour in the case of each child were made by the parent, teacher, and treating physician. Dr. David reported that a statistically significant and behaviourally obvious improvement was observed by all evaluators, which suggested that there was strong evidence for a causal relationship between lead and hyperactivity.

Some of the most interesting research on effects of low level lead exposure was presented by the two British workers, Drs. Yule and Lansdown, who conducted a pilot study of 167 children in Greenwich, London, in order to analyse their behaviour and IQ in relation to blood lead levels. Several types of behavioural assessment were used, including the method used by Prof. Needleman in his important study of behaviour in relation to dentine lead levels. In Yule and Lansdown's study, which is to be repeated, lead levels were found to be inversely related to children's performance in tests of spelling and reading — even allowing for the very significant social/educational/parental factors. The assessments made by teachers of children's performance in the classroom agreed very closely with the earlier findings of Needleman.

Children were found to be less persistent, more distractible and impulsive and to day dream more, the more lead they had in their bodies. Yule and Lansdown's work points to the possibility of a threshold effect of lead at as low as 12 ug/dl, and a mean difference in IQ, between children with low and elevated blood leads, of 7 IQ points.

Dr. G. Winneke, of the Medical Institute of Environmental Hygiene, University of Dusseldorf, presented findings from two studies of behaviour related to dentine lead levels in groups of children in Duisburg, and in Stolberg. In the earlier Duisburg study, full-scale tests revealed a 5-7 points IQ deficit among children with higher dentine lead levels. In the second survey, a correlation between verbal IQ and tooth lead levels was revealed but Dr. Winneke considered that the relationship was probably not causal, as the effect was partialled out by socio-hereditary factors. Attentional deficits, however, did appear to be directly related to dentine lead levels even when account was taken of social factors. Winneke concluded that the increased error score produced by the high Pb group could be considered a lead-induced CNS dysfunction.

Professor Rutter took a keen interest in the proceedings throughout and questioned speakers closely on their methods and findings. He concluded with a masterly summary of the evidence which had been presented, drawing out the scientific inferences based on that evidence and the value-laden policy implications that stemmed from the inferences. His closing remarks as Chairman deserve far more space than this packed issue of *Clean Air* will allow. The following extract, however, is peculiarly pertinent since it demonstrates how nearly Prof. Rutter's thoughts on lead and health match those of the NSCA's Council (illustrated by its recent statement on Lead in Petrol, and by the Society's evidence to the Royal Commission, published elsewhere in this issue):

"The research findings tell us that there is a probability (although not certainty) that low level lead exposure may have important adverse psychological effects. These effects are not large and it is clear that there are many other more important influences on psychological functioning. Moreover, it is probable that there are considerable individual differences to susceptibility — related to age, ethnicity, nutrition, social variables and other factors as yet imperfectly understood. But, the risk seems to be substantially more than a trivial one and, at least in some individuals, the effects are likely to be of practical importance in causing impairment of functioning.

The implication is that we now know enough to warrant taking such public health actions as are likely to reduce lead pollution in the environment, provided such actions do not have other hazards and provided they are not prohibitively expensive. The removal of lead from petrol would seem to be one of those worthwhile and safe public health actions. The evidence suggests that the removal of lead from petrol would have a quite substantial effect in reducing lead pollution and the costs are quite modest by any reasonable standard. Other countries, such as the United States, have already taken action and there is every reason that Britain should do likewise. In my view, the reduction of lead in petrol to an intermediate level is an unacceptable compromise without clear advantages and with definite disadvantages.

But, equally, it is very apparent that the lead in petrol constitutes but one of many sources of lead pollution. In the concern to deal with the hazards from petrol we should not overlook these other hazards that demand equal attention. But also, a concern that other actions are needed, which indeed they are, should not blind us to the value of the one immediate step that could and should be taken — namely, the removal of lead from petrol. Of course, we need to be clear that this step will **not** bring about **major** improvements in the health and development of British children as a whole. If we claim that, we are raising false expectations and we run the real danger of a backlash when those hopes are unfulfilled. They **will** be unfulfilled because the ill-effects of low level lead exposure are relatively slight, because there is an as yet ill-understood marked individual variation in response to lead and, most of all, because we know that there are many other more powerful influences on cognition and behaviour. But, the reduction of lead in the environment **should** make some **worthwhile** difference to some children and that ought to constitute a quite sufficient justification for action **now**."

BRITAIN, EUROPE, AND THE ENVIRONMENT 1982

Friday, September 24th 1982

A major conference to mark the 10th anniversary of the initiation of the environmental programmes of the E.E.C.

The conference provides an opportunity for a fresh examination of the effectiveness of the supra-national approach to the management of the environment and the control of pollution, together with an analysis of the challenges that membership of the European Community has provided to British legal and administrative practice.

Key speakers include: Dr. A.K. BARBOUR (Rio-Tinto Zinc Corp. Ltd.), A.J. FAIRCLOUGH (Director for the Environment, European Commission), Dr. M.W. HOLDGATE (Chief Scientist and Dep. Secretary, Department of the Environment), Dr. KONRAD VON MOLTKE (Institute for European Environmental Policy), SIR GORDON SLYNN (Advocate-General, European Court of Justice), PROFESSOR T.E. SOUTHWOOD (Chairman, Royal Commission on Environmental Pollution).

The conference will be opened by THE LORD FLOWERS (Rector, Imperial College)

Date: Friday 24th September 1982
Venue: Imperial College of Science and Technology, London
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Further information and application forms: The Conference Secretary, Imperial College Centre for Environmental Technology, 48 Princes Gardens, LONDON SW7 1LU.
Tel: 01 589 5111 ex. 2860

DARK SMOKE AT NIGHT

"Bus Burning" is a colloquial expression for scrap merchant/vehicle dismantling operations carried out mainly at established yards, but not always by reputable operators. The responsible way of dismantling vehicles is to cut them up bit by bit using oxy-acetylene torches. However, irresponsible operators burn vehicles whole thus causing considerable quantities of dark smoke. Such operations, which would be in breach of the Clean Air Act, 1968 Section 1 or indeed of the 1956 Clean Air Act, Section 16, are being carried out at night in at least one area of the country. The resulting emissions of smoke are adding to the ambient smoke levels, and, where such sites are adjacent to or near to houses, causing a nuisance to residents — whether or not they are prepared to give evidence to that effect.

The particular local authority concerned have found prosecution in such cases difficult, because it is impossible to prove emission of "black smoke" (as dark or darker than Ringelmann 2) at night, even though the environmental health officers are patrolling the area and could testify to the fact that such operations are going on. Prosecution is also difficult due to the defence under Section 1 of 1968 Act of "Inadvertent" smoke emission: the operators could claim that they were using oxy-acetylene torches in the responsible way and the vehicle was "accidentally set on fire" during the process.

When the local authority has successfully prosecuted, "derisory" fines, e.g. £10, were imposed by magistrates.

Some operators, who are "hardened criminals of no fixed (home) abode", have actually assaulted environmental health officers, and apparently have so intimidated nearby residents that they are reluctant to provide evidence of nuisance as required under the 1936 Public Health Act, amended by the Clean Air Act, 1956 Section 16.

The local authority have decided that an absolute offence is required for cases of this nature, similar to that introduced by the Control of Pollution Act with respect to cable burning. It wants the law to be amended so that "bus burning" operations are illegal, without the defence of "inadvertent" smoke emission, and without the requirement imposed upon the local authority to prove the colour of the smoke.

There is one amendment to Clean Air legislation, currently before Parliament, which might help with regard to action taken on the nuisance aspect of such smoke emissions. The Local Government Miscellaneous Provisions Bill, which should receive Royal Assent this summer, contains a clause (25) which removes the limitation on those affected by a nuisance. At present, nuisance must be proved to affect "the inhabitants of the neighbourhood"; the proposed amended wording is "injurious to health, or a nuisance". A local authority could therefore act on its own initiative if it felt that a nuisance was being caused, and would not have to rely on complaints made by residents.

In relation to the difficulty of obtaining evidence of dark smoke emission at night, suitable evidence might be obtained by relating metered effects of smoke emission at night to shades of daytime smoke emission which had similarly been metered.

The Society would be very interested to hear from local authorities who have experienced problems with unscrupulous "bus-burners", or indeed similar problems of dark smoke emission at night. Details of successes in obtaining evidence and securing prosecutions would be particularly welcome. Please contact the Editor, or the Society's Secretary General.

ROLE OF THE ENVIRONMENTAL HEALTH OFFICER IN VIBRATION AND NOISE CONTROL ON BUILDING AND HEAVY INDUSTRIAL PROJECTS

Alan Henderson

Assistant Chief Environmental Health Officer, York City Council

Paper Presented to the National Society for Clean Air meeting on 21st April 1982 in the Guildhall, York.

INTRODUCTION

The paper deals first with the changes brought about by the introduction of the noise control provisions within the Control of Pollution Act (COPA) 1974, the operative date of which was the 1st January 1976. Two case studies are then presented, both of which involved major use of the staff resources of the York City Environmental Health Department. One case covers the method of approaching the problem of piling and building in densely occupied areas with many listed buildings of considerable historic interest nearby. The other indicates the difficulties involved in using the statutory provisions to obtain a remedy when dealing with nuisance involving large national companies.

PROVISIONS TO CONTROL NOISE AND VIBRATION UNDER COPA, PART III

The Act (Section 73) states in one line, 'Noise includes vibration': this creates many problems for enforcement Officers. There are no Codes of Practice available and very little information with respect to acceptable levels of vibration in terms of human response or likely building damage. Nearby installations of computers or areas where vibration free environment is required must all be given full and adequate consideration to ensure that nuisance is not permitted.

Sections 60 and 61 give Local Authorities certain powers in respect of prior approval to enable them to control excessive noise from construction sites. Included within these Sections are notes referring to construction sites but no strict definition appears within the Act. The provisions of both Sections apply to (a) the erection, construction, alteration, repair or maintenance of buildings, structures or roads, (b) breaking up, opening or boring under any road or adjacent land in connection with the construction, inspection, maintenance or removal of works, (c) demolition works, and (d) whether or not they are included in the above three paragraphs, any works of engineering construction.

The provisions within the Sections enable Local Authorities to regulate noise before or after commencement works. However, it is important to realise that the law has previously accepted that it is inevitable that some noise will be associated with construction, and relief has been given at common law, where a noise is temporary or works are carried out with reasonable care or skill, to prevent unnecessary annoyance or disturbance. Section

60 of the Act enables the Local Authority to serve Notice imposing requirements as to the way in which the works are to be carried out. The notice may specify the plant or machinery which is or is not to be used, it may specify the hours during which the works may be carried out, and specify the level of noise which may be emitted from the the premises in question or at any specified point on those premises, or which may be so emitted during specified hours, and provide for a change in the circumstances.

The powers contained in the Act are very far reaching and to enable proper implementation it requires not just some knowledge of acoustics but also a reasonable understanding of Civil Engineering and building technology. Arrangements have been made locally whereby the enforcing Department of the Authority is alerted early in proceedings either by the Planning Department or the City Engineer and Surveyor direct. This highlights any potentially difficult cases where noise is likely to be a significant problem.

When taking action within the provisions of Section 60, the Local Authority must have regard to the provision of any relevant Codes of Practice issued under this part of the Act. One such Code, British Standard 5228 1975, entitled "Noise control on construction and demolition sites", is frequently used when making any assessment of likely site noise. It also places responsibility on the Authority to ensure that best practicable means are employed to minimise noise. There is a definition of "practicable" in Section 72(2) of the Act: *".... reasonably practicable having regard among other things to local conditions and circumstances to the current state of technical knowledge and to the financial implications. The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures".*

It is essential that Local Authority Officers must not adopt the blinkered approach when specifying plant or machinery; they must also have regard to other satisfactory methods of operation which would be equally effective in minimising noise. In paragraph 4 of Section 60 there is an indication that the Local Authority must have regard to the protection of any person in the locality. It is very significant that the emphasis here is positive on the side of protection rather than negatively directed at disturbance of persons in the locality.

An interesting factor of the service of Notice under the provisions of this Section is that the Notice is served on the person responsible for the works and he has a right of appeal to a Magistrates Court within twenty-one days of a service of the Notice. Appeal procedure is fully defined in the Act and there is a comprehensive set of regulations dealing with the appeal procedure (Control of Noise (Appeals) Regulations 1975).

In York, firms are actively discouraged from applying for prior consent within the provisions of Section 61. However, a firm wishing to carry out works that fall within those specified previously may apply to the Local Authority for consent. If the work in question requires approval under the Building Regulations, then the application may be made at the same time. Any such application must contain full details of the works and the method by which they are to be carried out, and the proposed steps to be taken to minimise noise. It is normal procedure for the Local Authority to send to the Developer a full and detailed questionnaire covering all the relevant points of interest. The information given must then be assessed and if works are sufficient to minimise noise, and if subsequently they are executed in the manner described, the Local Authority are not in a position to serve Notice within the provisions of Section 58 of the Act.

Any person aggrieved by the levels of noise emanating from a site which has been subjected to prior consent can still take action through the Courts themselves, by virtue of Section 59.

Any application for approval to the Local Authority has to be acted upon within twenty-eight days. If the Authority do not give a consent within the twenty-eight days or do so attaching conditions that the applicant does not accept, the applicant may appeal to a Magistrates Court within twenty-one days from the end of that period. If one considers the definition in the Act, it is not difficult to realise the excessive number of applications which could be submitted if all Contractors were to make use of this legislation.

British Standard Code of Practice for Noise Control on Construction and Demolition Sites (B.S. 5228/75)

The Code provides guidance on methods of noise control in respect of buildings, civil engineering, construction and demolition works and aims to enable any one with an interest in the subject effectively to control noise emissions from their sites. In addition to the formal procedures outlined in the Code, the need for good community relations is also stressed. It is further recommended that personnel using noise producing equipment should have adequate training and be informed fully of their responsibilities to the community at large.

In general, the Code can be regarded as being divided into two subjects. First, hearing conservation, and noise and neighbourhood disturbance. The former will not be discussed here, as this subject is dealt with mainly by the Health and Safety Executive.

When considering neighbourhood noise, it must be realised that disturbance can be due to a variety of factors which may intrude on work, leisure or sleep; it is not possible to agree on a simple level as the effect of noise is subjective, some persons being more sensitive to noise than others. The Code recommends that the sound levels be measured in dB(A) and assessment is based on the continuous equivalent sound level, the Leq. The Leq can be regarded as a notional level which would cause the same A weighted sound energy to be received as that due to the actual sound over a period of time. When the Department considers noise from construction or demolition sites, regard is given to the existing ambient noise level.

In discussing noise control, it must always be remembered that noise at source can quite often be controlled by substitution of plant or by the modification of existing equipment, together with the careful siting of all the equipment. This is one of the fundamental principles of noise control. One must always remember that increasing the distance between the source and the receiver is one of the most satisfactory means of reducing noise levels. The role of the enforcement Officer of the Local Authority is generally to protect the public, and if at any stage during the operation the agreed levels are not adhered to, and after consultation all discussions fail, then the remedy must be left to the Courts.

It has been found in the City that the enforcement provisions brought about by the changes in January 1976 have enabled the Local Authority to exercise much more effective control over a considerable range of activities which have traditionally created problems for the Authority by disturbance to residents. It is appreciated by enforcement Officers generally that they cannot unnecessarily burden a contract with undue costs which have directly to be met by the public; it is essential that the Officer balances his duty to the community with this responsibility.

CASE STUDY ONE

The Development of the Coppergate Site commenced many months ago following a decision by the York City Council to invite six building contractors to take part in a competitive scheme to design a suitable development on the Coppergate Site. Wimpey Group Services' submission was eventually accepted and formal planning application approved. Very early in the proceedings, it was agreed to set up eight Officer Working Groups to formulate technical policy in respect of the development; the numbers of groups has now been reduced as some were cumbersome due to the functional overlap. The Environmental Health Officer is involved in the Constructional Group and in the Space Useage Group.

In June 1981 two comprehensive technical reports were prepared, the Council's report being produced by the Pollution Control Officer of the Department of Environmental Health, and the Developer's report by Wimpey Laboratories. There are very few available papers on the effects of vibration and there are no specific codes of practice in existence. The outcome was that two completely unrelated proposals and sets of standards were put forward for discussion. The author had the pleasure of chairing the meeting of the Technical Officers when agreement was eventually reached and a limit was established to minimise any likely damage to the adjacent buildings. The unit measurement finally agreed was the vibrar: this unit represents a scale of power of vibration (HW KOCH 1953) and takes frequency into account. The scale of maximum vibrar unit was agreed with respect to the adjacent buildings, namely the Heritage Centre and Fairfax House, where a maximum of 30 vibrar was decided upon, and at the other end of the scale the modern buildings, where a maximum of 38 vibrar was to be used. (See Appendices One and Two). A test piling set up was carried out and this indicated that it was unlikely that hard driven piling could be closer than 15 metres to the Heritage Centre.

It was apparent that buildings around the site would also be subjected to vibration from other site activities apart from the piling operation. There would be heavy vehicles

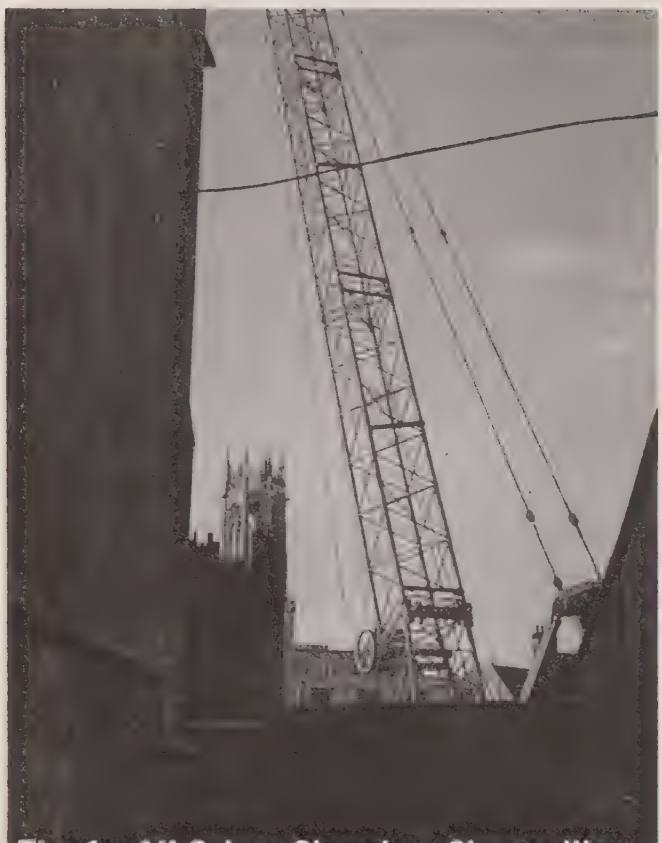

Fig. 1. All Saints Church — Sheet piling showing Pilemaster Crossheads

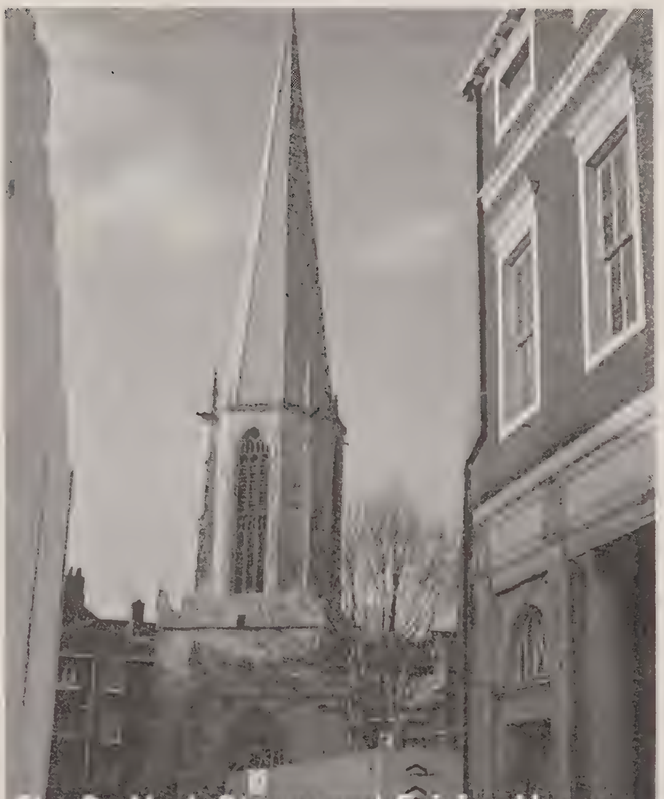

Fig. 2. York Storey and Fairfax House — showing proximity of listed buildings.

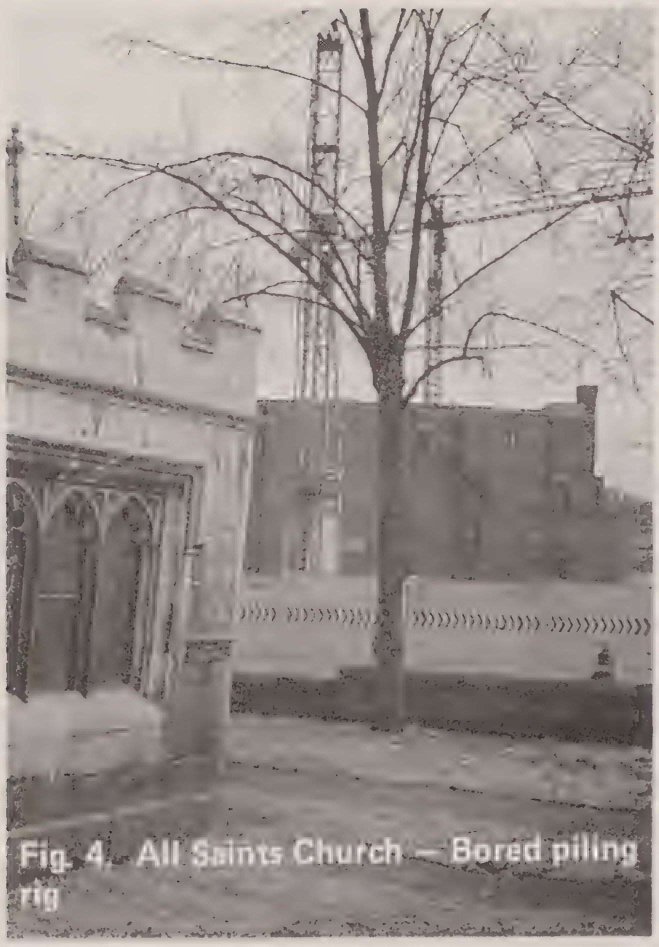

Fig. 4. All Saints Church — Bored piling rig

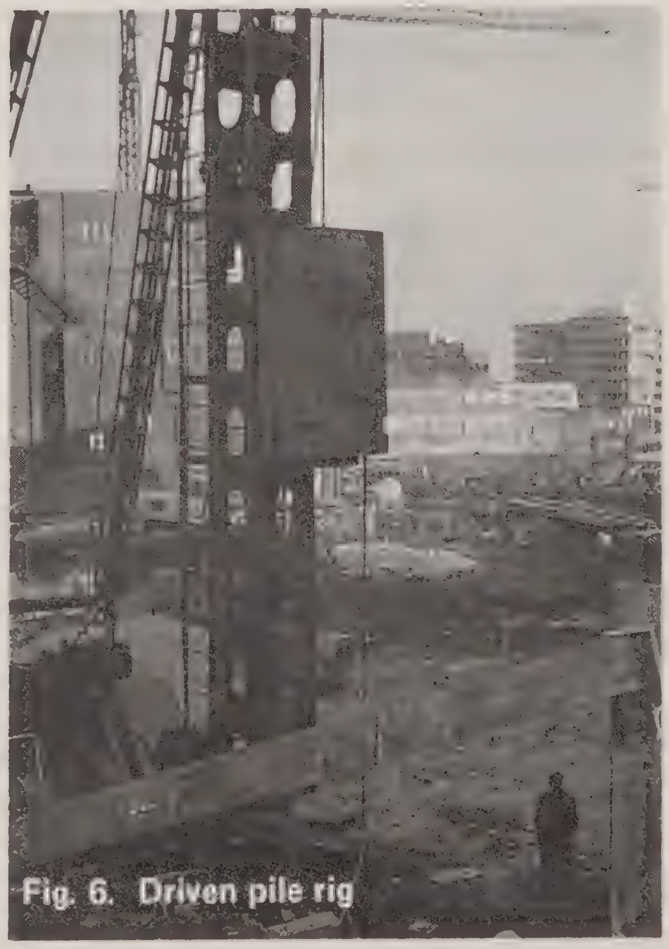

Fig. 6. Driven pile rig

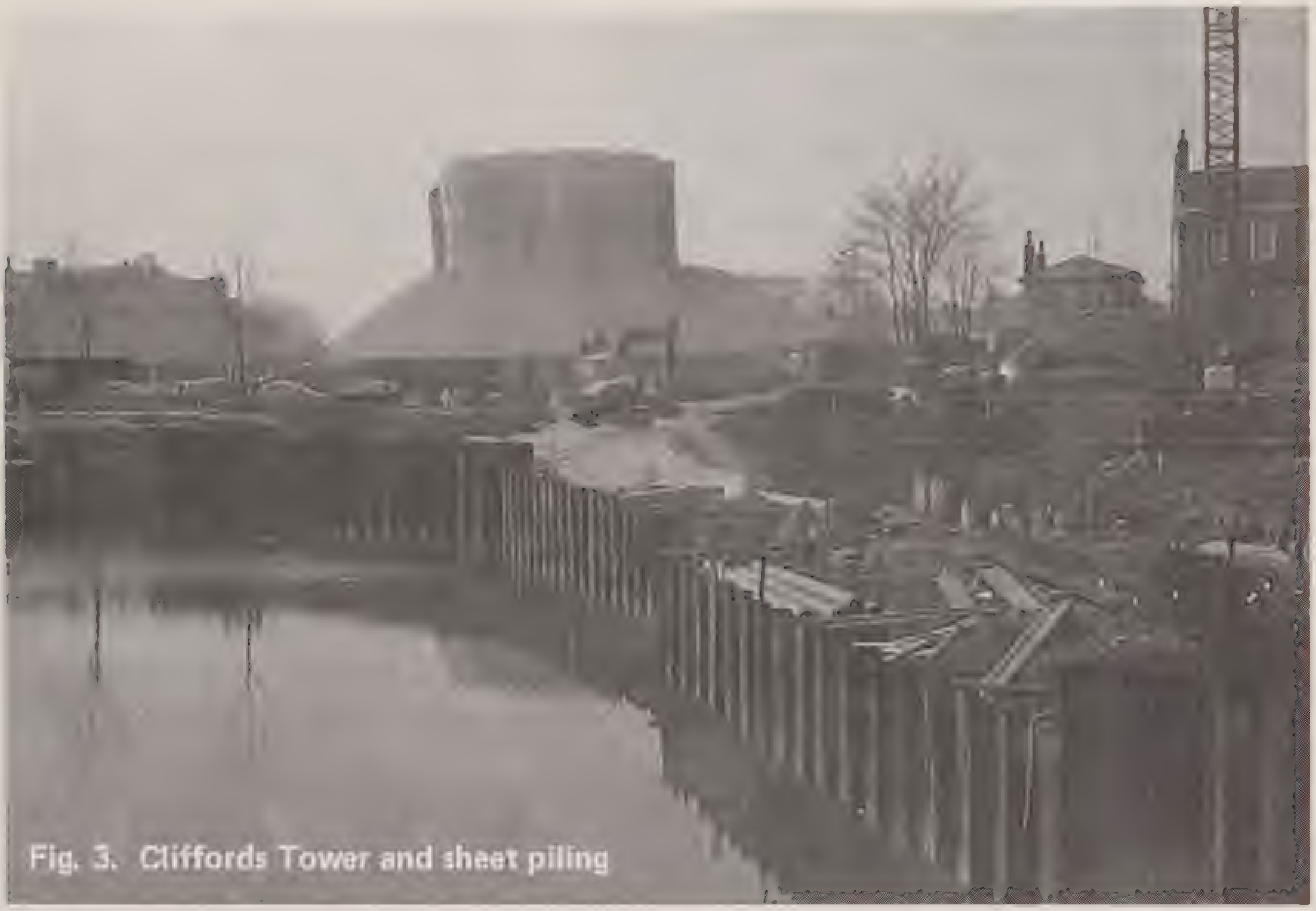

Fig. 3. Cliffords Tower and sheet piling

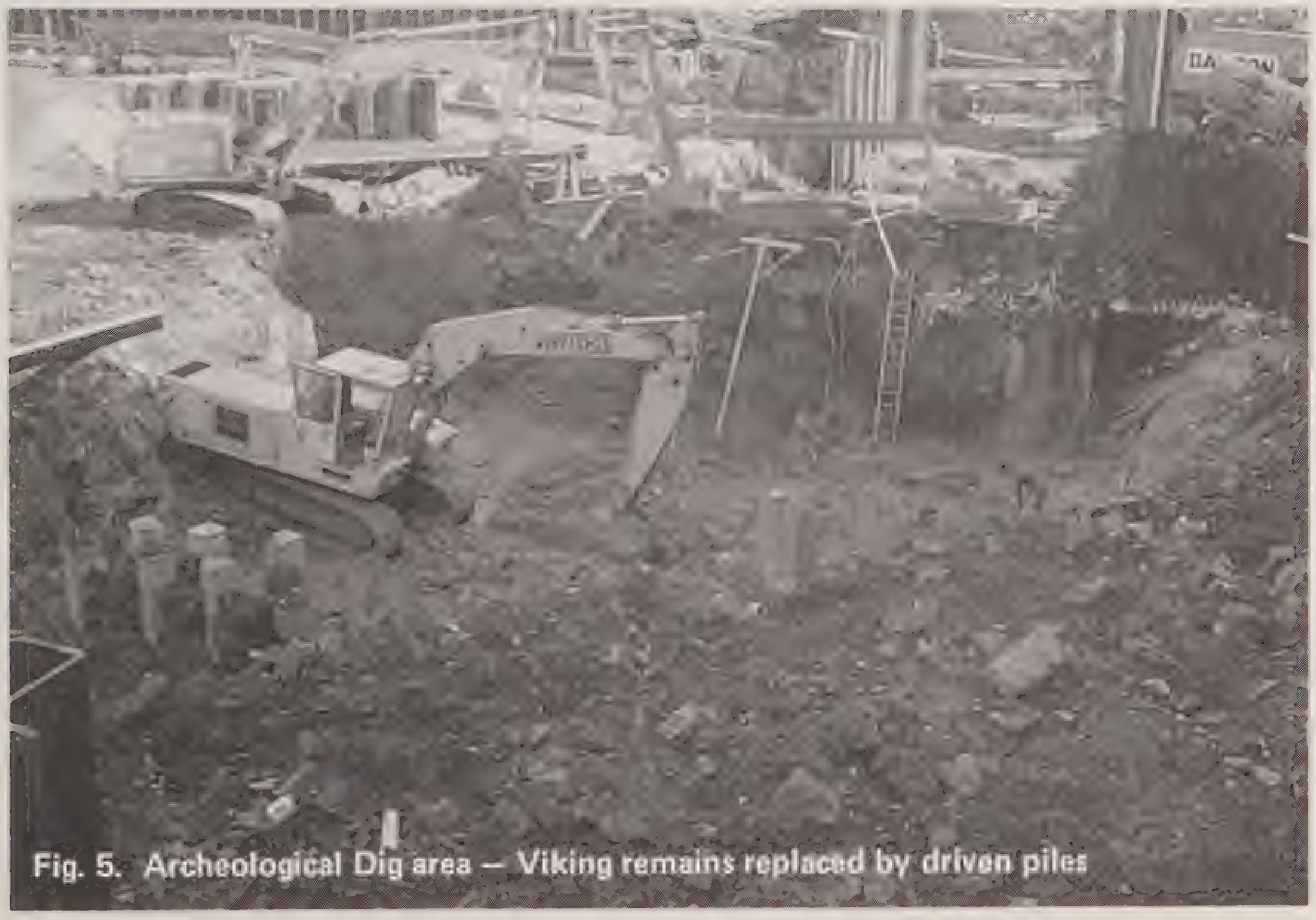

Fig. 5. Archeological Dig area – Viking remains replaced by driven piles

passing over unmade ground, and other general constructional activities which create considerable vibration.

It was apparent that buildings around the site would also be subjected to vibration from other site activities apart from the piling operation. There would be heavy vehicles passing over unmade ground, and other general constructional activities which create considerable vibration.

Whilst all the technicalities were being discussed with Officers, the formal public participation exercise within the planning legislation constraints was meeting with many mixed responses. The majority of the response was full of praise for the proposed development, but a few reservations were also expressed.

A Consultant acting on behalf of one of the occupiers of an adjacent building strongly advised against any use of hard driven piles. He had stated in a letter that his twenty-five years of experience had involved him in dealing with some 300 piles of varying types in mixed areas. It is worthy of note that the Coppergate Site involved some 800 piles for direct bearing and many hundred metres of sheet piling, the majority being driven in a sixteen week time period.

Having considered the report of the site investigation, it was evident that in the prevailing ground conditions, difficulties might be encountered in the construction of bored piling and this would be very uneconomic with the required pile lengths. Technical difficulties were also presented by the necking or possible necking of the pile shafts, due to the water bearing granular layers. Consequently it was agreed that the most suitable system for this site was the continuous flight augered and grout-injected piles or driven pre-cast piles; the latter would prove to be the most economic.

The site being developed was completely submerged in water in 1068 following the damming of the River Foss so that fortification by moat could be arranged. The damming resulted in the formation of a lake known as Kings Fish Pool. This lake slowly silted up over the years and in the 18th century, the Foss was canalised along its present course and the remaining area reclaimed. In speculations, it was said by the Archeological Trust that the original course of the Foss runs beneath the Cinema in Piccadilly. This explains why almost eight metres in depth over the site is of made-up ground, which could create some driving obstructions for the piles.

Having regard to the proposals to mix residential and commercial units in line with the Lord Esher's findings in his report, the author issued a general guideline for environmental noise emanating from the finished development. The terms of this guide require that noise emission is to be less than a noise rating of 30 during the hours of 2200 to 0700 and a noise rating not in excess of 35 during the remaining day time hours when measured at one metre from the facade of any noise-sensitive building. All plant and machinery which may affect dwelling units shall be adequately and effectively mounted to prevent any vibrational disturbance. Air movement from inlet and outlet of ducting and vents shall be so sited and air movement attenuated so as not to create nuisance.

The majority of the problems relating to individual units are being picked up by our Officers in the normal weekly planning and building regulation meetings. Many of the problems previously encountered with insular units within Local Government were fortunately destroyed with reorganisation. It is still possible to encounter certain Officers who attempt to obstruct progress; one such Officer, having sat through the many preliminary meetings when all matters were being explained and considered, sent a memorandum to the Environmental Health Department as follows:—

> "Regarding the proposal to drive test piles in the vicinity of Council property, in no way can this Department be associated with the use of driven piles in the area, whether insurance coverage is obtained or not. I wonder if York would now just be a pile of Roman rubble had we all attempted to stop progress and impede Council Policy."

It is now possible to state that the Department's calculations were fully as anticipated and that the 'no damage' criterion for driven piling was successful. Some problems did occur when pile extraction was taking place and, without prior consultation, the developer's specialist contractor reverted to a vibratory system of extraction. This system unfortunately operated at a frequency in the region of the natural frequency of the building elements and loose fill. This method regrettably satisfied the conditions for a build-up in a resonant vibration and resulted in structural damage to two buildings and a certain amount of ground settlement. The claims involved are now being discussed with the affected parties and the developer. The site is still in progress and is developing satisfactorily. An attempt has been made to indicate the many changes occurring and mention should also be made of the deep involvement of Environmental Health Officers throughout the country. The assistance of the City's Pollution Control Officer, Mr. Jim Thompson, is gratefully acknowledged. He has spent many laborious hours researching all the associated problems in respect of this and many other developments in the City.

The second case study involves statutory enforcement relating to the noise and vibration created in the manufacture of vehicle bodies for a national transporting company (which employs several thousand York residents).

CASE STUDY TWO

Some two years ago, to keep up with progress and development, the Company installed a replacement press of 700 tonne capacity in place of their previously used 500 ton press. At the same time other forming and cutting equipment was also introduced. During the piling operation to form the base of the 700 tonne press, complaints of noise and vibration nuisance started arriving at the office counter. Upon investigation, both during the installation and the setting up procedure for this new equipment, it was established that the allegations were justified. The Company management were made aware of the associated problems and informal discussions took place. For several months, many promises were made but no effective action was seen to be occurring. The matter was then reported fully to the Environmental Health and Control Committee. The report recommended the service of a Statutory Notice on the Company in respect of the 700 tonne press and two profile cutting Trumpf machines.

Upon receipt of the Section 58 Notice, the Solicitors acting on behalf of the Company quickly replied with a counter appeals notice within the terms of the legislation. In discussions following the service of the Notice, it was decided by the Company that they would not press the Magistrates Court for a hearing and asked that it be adjourned 'sine die'. This was agreed to by the Officers of the Authority as assurances had been given that the Board were to employ an outside Consultant to look into their problem and attempt to find an effective solution. The Consultant commenced his investigation with certain assistance from the Local Authority Officers and many changes in procedure were tried and tested — and some failures did regrettably occur. During this testing time, the Company made a definite decision not to inform the nearby residents of any of their actions: this particular decision has created untold problems for the Local Authority Officers generally. During a holiday break, management had decided that it would be useful to install a further two guillotine-type presses; these were picked up by the residents as soon as the works returned from the break. This change in circumstances was fully reported to Committee and it was agreed that further Notices covering the whole site and operation should be served on the Company. These new Notices superseded all the previous Notices and placed more severe restrictions on the Company's operation and and involved the Company in stopping completely their night shift operation. For some unknown reason no appeals notice was received in respect of the second, more severe, Notice. It could only be assumed that the Solicitors were properly advised on that occasion by their Technical Officers.

Much progress has been made to date, following many lengthy meetings with the Company management; after considerable expenditure, the main building is completely enveloped by an effective sound absorber, the windows are all effectively bricked up, and an acoustic entrance vestibule has been constructed. Full air conditioning has been introduced and the problem machines, other than the 700 tonne press, have been given suitable attenuation seating or clamping. The 700 tonne press still remains a problem, although the most recent experiment in slowing down the power stroke appears to be a possible success: sanction for the permanent modification has now been given and monies made available. It became very apparent when dealing with the Company that the only way any satisfactory result would be achieved was by the use of the enforcement provisions of the Act on behalf of the Local Authority. Their refusal to become involved in any public relations exercise whatsoever has caused the Company to be regarded with complete distrust both by the Unions and by the adjacent residents. It seems probable that in the near future a report can be prepared for Committee telling them of the success and the total completion of the works so that a full night shift may be recommenced.

In preparing this paper, an attempt has been made to provide some general advice, and give some information as to the level of new technology that Environmental Health Officers are having to seek, a task which proves at times to be quite difficult. Information received from colleagues within the City and from other authorities in the country is gratefully acknowledged. It is emphasised however, that any thoughts contained in this paper are not necessarily the policy of the York City Council.

APPENDIX 1 THE VIBRAR UNIT

Scale of Power of Vibration (H W Koch 1953)

A scale based on the power of Vibration has been used for many years in the Curt-Risch-Institute of the Technical University of Hanover.

The degree of vibration is defined as

$x = a^2 f$ where a = acceleration

Its connection with the power of vibration results from the following

$L = 2\pi^2 a^2 f^3$ (for mass = 1)

$X = a^2 / f = 16\pi^4 a^2 f^3 = 8\pi^2$

The quantity is therefore proportional to the power. For practical reasons a logarithmic form of unit is used, the measure of power S being then defined as follows:—

$S = 10 \lg X/Xs$

Here Xs is a relative value which, as a result of numerous measurements can be taken as $Xs = 0.1\ cm^2/5^3$. Since there does not yet exist a unit for the power of vibrations, and because such a unit would be useful, the name "vibrar" (abrev. vibr) is suggested for it; it it is formed from the latin word "Vibrare".

If the measurement of the power of vibrations increases by 1 vibrar, it means an increase by the factor $100\sqrt{10}$ (i.e. by 1.023 times) in relation to Xs.

Besides the quantity X one can deduce a unit for the power of vibration from other known quantities from the value of acceleration.

$Sa = 20 \lg \frac{a}{ls}$

velocity

$Sv = 20 \lg \frac{v}{vs}$

amplitude of deflection

$S_A = 20 \lg \frac{A}{As}$

The basic quantities a_s, v_s, and A_s are determined in such a way that they correspond to the value $X_s = 0.1\ cm^2/s^3$ with a frequency of 1 Hz.

Therefore $a_s = 0.316\ cm/s^2$
$V_s = 0.05\ cm/s$
$A_s = 0.008\ cm$

So for velocity measurements

$$Vibr = S = 20 \lg \frac{(Vo)}{(0.5)} + 10 \lg f$$

Where Vo is the measured peak velocity in mm/sec

and $Vo = 0.5 \left(\text{Ant. } \lg \frac{(S - 10 \lg f)}{(20)} \right)$ in mm/sec

APPENDIX 2

CHOICE OF MONITORING (CRITERIA FOR DAMAGE ASSESSMENT)

The draft revision DIN 4150 Code of Practice, provides a useful guide for the vibration limits to be set for several classes of building.

The allowable magnitude of vibration used in the code are based upon levels monitored from blasting in rock.

This code of practice places all 'ancient buildings' in one class. To place buildings in one class because of age regardless of construction, state of repair or importance can not be right. Crockett has given the two extremes of 'ancient building' the "Great Pyramids and Lincoln Cathedral". To allow a limit of 2mm/sec for such a structure as Lincoln Cathedral would be out of the question.

The recommendation in the draft code, is that the peak particle velocity be measured outside the building under consideration at one metre from the building. The peak particle velocity being derived from the Vectoral components of the three mutually perpendicular axis V_x, V_y, V_z by taking it as $\sqrt{V_x{}^2 + V_y{}^2 + V_z{}^2}$.

As the maxima of these three components are unlikely to arrive simultaneously the formula introduces a partial factor of safety. However, very little has been published on relative response of buildings to each component of the ground vibration input.

To monitor the three axes simultaneously requires rather advanced instrumentation which is not yet available to the department.

Measurement via tape record and subsequent analysis is in effect 'after the event' which is acceptable for test operations to assess likely levels of vibration from further piling operations but is not acceptable for site monitoring and policing levels of vibration during actual construction work and piling operations.

For these reasons the DIN code of practice is not used as a method of assessing possible building damage. The limits together with the suggested method of measurement is impracticable and unlikely to reflect the level of building response to the ground vibrational input.

The method of measuring chosen for the test piling operations was to monitor at various points on the nearest affected building. The three axes X Y Z were monitored at different times using a single accelerometer to measure peak velocity.

Tape recordings were taken at various times to establish the dominant frequencies by later analysis.

As stated in the report the levels were measured at the top of the buildings. A structure generally responds to a vibration input in its own unique way depending upon its dimensions, method of construction materials used, state of repair etc. In almost all cases some form of amplification takes place through the structure to the highest level. Measurements of vibration are invariably of greater magnitude at the top of a structure than anywhere else on the structure (excluding some floors). Thus measurements taken at roof level represent to some degree the maximum levels of the buildings response to the vibration input.

In practice the broad band 0.2 Hz to 1 kHz measurement is obtained for Peak Velocity and the dominant frequency, of the buildings response, found. This frequency is then used, together with value of peak velocity measured, in the equation below to give a value of Vibrar.

$$\text{Vibrar S} = 20 \lg \frac{(V_o)}{(0.5)} + 10 \lg f \text{ mm/sec}$$

Once the dominant frequency of the buildings response has been established it is only necessary to monitor the Peak Velocity.

This is not an ideal method but in the absence of other suitable methods and instrumentation, it will suffice for the monitoring of vibration levels of the piling operations to the levels suggested in the report.

J.H. THOMPSON
Pollution Control Officer

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ENVIRONMENTAL POLLUTION AND INDUSTRIAL CHANGE IN THE WEST MIDLANDS

Seminar Report by **Trevor Townsend**

On the 7 April 1982 representatives from local authorities, industry, water authorities and the Department of the Environment attended a seminar at Aston University under the auspices of the Joint Unit for Research on the Urban Environment, entitled "Environmental Pollution and Industrial Change in the West Midlands". The stated object of the seminar was to discuss what, if any, were the effects on levels of environmental pollution in the West Midlands as a result of the decline in the region's traditional industries.

Dr. David Norse from the DOE's Central Directorate on Environmental Pollution opened the morning session by giving the DOE's view of the national trends in pollution over the past decade, the current situation, and their thoughts on future trends.

Dr. Norse stated that it was clear from monitoring carried out by government departments and regional and local authorities that as a result of general environmental policies and specific regulatory controls gross pollution had been widely reduced. He had to admit however that these controls were in many cases not the sole or even the dominant cause of the improvement in environmental quality. Improvements had also occurred from a combination of economic decline and structural change in industry, particularly contraction of the manufacturing sector through falling international competiveness. Thus some of the gains in environmental quality had been associated with high social costs of unemployment quality had been associated with high social costs of unemployment and short-time working. Examples of this appeared to be particularly clear in the North West of England and the West Midlands.

However the results of the economic decline were not always environmental improvements, as in some cases it was believed that levels of pollution may have risen due to lack of investment and poor maintenance of pollution control equipment, a view echoed from the floor by a number of environmental health officers.

Dr. Johnson of JURUE elaborated on this structural change in industry in the UK, stating that between 1965 and 1979 the reduction in employment in the manufacturing industries had been compensated for by the service industries. Since 1979, however, the service industries also had suffered a decline and it was likely that there would be no fundamental change in this trend for at least a further decade.

This trend showed up particularly well in the West Midlands where 60% of the labour force was dependent on the metal industries.

The first two speakers, having set the scene of general economic decline in industry, were followed by Dr. Pocock also from JURUE who outlined the study undertaken by JURUE into this specific problem.

Dr. Pocock indicated that the study, which had been commissioned by the DOE and carried out in conjunction with the West Midlands Authorities, had shown that in the case of overall levels of air pollution there had been a reduction, not least as a result of the closure of two major steelworks and 30% of the iron foundries in the area over the last ten years. However in the case of emission from individual works continuing in business there had been no reduction, echoing the point made by Dr. Norse that firms were cutting back on the non-productive areas of maintenance and investment in more efficient pollution control techniques.

The study also revealed that the total metal content of trade effluents discharged to foul sewers had fallen by 10% per annum for the last four years with a resultant improvement in river quality, but the decline had still not been sufficient to allow the contaminated sewage sludge to be used for agricultural purposes.

Dr. Pocock did point out, however, that the reduction in metals content had not been consistent, and in particular, levels of cadmium had risen consistently at all sewage works, a situation he was unable to explain.

The morning session was concluded by John Elkington of Environmental Data Services Ltd. who looked at the trends in industry and pollution during the 80's. Mr. Elkington felt that the shift away from the manufacturing industries would continue with the new industries, in particular the electronics and service sectors being set up around a new axis stretching from Exeter by way of Milton Keynes to Norwich, thus replacing the traditional London — Birmingham — Liverpool axis. The conclusion drawn was that most of these new industries generate a much lower output of pollution per unit of economic output and that many of them will be choosing to locate in environmentally pleasant surroundings. It was Mr. Elkington's view that these overall trends in structural and technological change would bring real improvements in the pollution performance of British Industry, but that greater efforts will need to be made to ensure that the appropriate pollution control technologies are also included in the new developments from the start.

The afternoon session looked at the specific areas of air, land and water pollution and was opened by Mr. G. Brownsword, Divisional Environmental Health Officer with Dudley M.B.C., who presented a paper on "Controlling Air Emissions from the Foundry Industry".

Mr. Brownsword gave a detailed appraisal of the industry and the types of emissions arising from particular processes and the legislation or lack of it available to local authorities to control these emissions. Particular reference was made to the failure of Central Government to implement the recommendations of the 2nd Working Party Report on Grit and Dust Emissions.

It was estimated that in 1974 in Dudley, of the 1531 tons of grit and dust produced from cold blast cupolas, 807 tons were emitted to atmosphere. In 1981, due to the closure of over half of the foundries and short time working in others, the total of grit and dust produced had fallen to 1000 tons of which 450 tons were emitted to the atmosphere.

Mr. Brownsword once again stressed the importance of maintenance of existing plant by industry but accepted that there was little likelihood in the present economic climate of extensive investment in either new metal melting techniques or pollution control equipment.

On this latter point Mr. Brookfield, Divisional Environmental Health Officer with Sandwell, asked Dr. Norse what likelihood there was that the Government would be prepared to invest by way of grant in maintaining the foundry industry in the West Midlands. Dr. Norse replied that in his opinion such investment was unlikely to be forthcoming as the policy of Government was to support the new technological industries, not to "prop up" the old, antiquated and ineffecient technologies.

J.W. Tubby, Assistant Divisional Scientist with the Severn Trent Water Authority gave a comprehensive presentation on the work of the Authority and explained the problems that arose from the discharges from the industries in the West Midlands. i.e. plating, galvanising, acid dipping, cyanide hardening etc. Mr. Tubby outlined the enforcement responsibilities of the Authority, and the work of the Pollution Control staff in particular, in seeing that the relevant treatment plant, flow measurement devices, balancing tanks and sampling chambers were installed by firms producing trade effluent.

Mr. J.W. Barrett of Thames Gameson & Sons Ltd., Walsall, was however not convinced that enough was being done to clamp-down on the "cowboys" of the industry who were able to undercut on costs of production by discharging their effluent to the sewer without any form of treatment.

Mr. Tubby replied that they accepted that this did occur but that the Severn Trent Water Authority were attempting to adopt a positive approach to such offenders and instituted some 30 prosecutions per year for illegal discharges.

The final session of the afternoon was presented by Mrs. Thelma Hillman, Pollution Control Officer with the West Midlands County Council Waste Disposal Section. Mrs. Hillman left the meeting in no doubt that at present the West Midlands area contained vast areas of contaminated land either as a result of illegal tipping or long-standing legitimate industrial use. Much of this the authority were aware of but an awful lot lay there undetected until developed for some specific use.

On this latter point Mrs. Hillman stressed that it was imperative that good liaison should exist between the County and District Councils and Water Authorities so that each was able to make a valuable input into the redevelopment of this contaminated land.

Mrs. Hillman outlined the licensing procedures for new waste disposal sites but had to admit that enforcement powers for contravention of licence conditions was totally inadequate and that on a number of occasions cases had been lost in the courts because of this. As a result West Midlands County Council were now reappraising all their waste disposal licences with a view to improving their enforceability.

UK POLLUTION RESEARCH CUTS ATTACKED AT UNEP HEARING

At the international public Hearing on the Environment, London June 15 & 16, cuts in DoE sponsored research into SO2 pollution and its effects were criticised by Geoffrey Lean, environment correspondent of *The Observer.* Speaking earlier at the Hearing, Michael Heseltine referred to the importance of co-operation in research, education and training in relation to concerted international action on common environmental problems. His remarks encouraged Mr. Lean to hope that Government moves to downgrade research into the long range transport of air pollution and its effects would be reversed. The DoE has cut its support for the research budget of WSL's Air Pollution Division by £400,000 for the current financial year, and its support for SO2 related research at the Institute of Terrestrial Ecology and Nottingham University's School of Agriculture has been terminated.

The Hearing was organised by the United Nations Environment Programme (UNEP) and brought together over 100 environmentalists, scientists, industrialists and government policy makers from 39 countries. Meeting at County Hall, they debated the state of the global environment policy, paying particular attention to desertification and problems of the atmospheric environment.

INDUSTRIAL NEWS

Methane Gas for Boardmaking

National Smokeless Fuels Ltd. and British Financial Union Ltd. have set up a joint company called Aveley Methane Ltd., to manage the exploitation of methane from one of the GLC's refuse landfill sites and pipe it to a local manufacturer.

During the next 12 months work will go ahead to tap and pipe the gas to Thames Board Limited, the U.K.'s largest manufacturer of packaging board, whose Purfleet Mill is close to the GLC's 70 acre landfill site in Aveley, Essex.

The methane at Aveley was revealed during tests into the source of smells complained of by residents. Studies were made to discover how best to extract the gas, use it as an energy source and find a suitable customer. It is thought to be the first time that any local authority in the country has exploited such a find on a commercial basis.

Experts from the GLC and NSF — who are specialists in this work, supplying methane from collieries and coke oven gas to industry in many parts of the country — estimate the extraction rate could be at least five million therms a year for the first five years, equivalent to 20,000 tonnes of coal per year. There is a strong probability of further substantial amounts of methane for extraction lasting up to another 10 years.

Estimated cost of construction of the plant and pipeline is £2.3 million to Aveley Methane Ltd., with a reasonably short pay back, sales of the gas enabling this to be re-couped within several years. Thames Board will also invest to alter burners on their large 200,000 lbs/hr boiler, and for additional internal pipelines within the Purfleet site perimeter.

Reader Enquiry Service No. **8215**

INCINCO win Queen's Award

The Incinerator Company Ltd. (INCINCO) have been given a Queen's Award to Industry for Export Achievement, in recognition of exports made in the last three years to 28 countries — mainly in the Middle East, Far East and Africa.

The decision to change the marketing emphasis from home to overseas involved developing a range of packaged and semi-packaged units of capacities from 35kg to 750kg/hour. Larger units are also made, for example the one tonne/hour semi-packaged incinerator despatched to Das Island in 1980.

The incinerators, all of which comply with current environmental emission standards, are supplied with refractories installed and pre-piped and pre-wired to reduce site work to a minimum. The simple control systems which are incorporated are especially suitable for unsophisticated markets. Because of the emphasis on energy conservation, an increasing number of units are now being supplied with heat recovery.

Reader Enquiry Service No. **8216**

Dust Control during Ship Loading and Discharge

The British Materials Handling Board, through its Dust Control Sub Group, have commissioned Cremer and Warner, Consulting Engineers and Scientists, to undertake a survey of bulk handling facilities at UK ports.

This study will determine the nature and magnitude of the problems of dust control associated with ship loading and discharge, covering occupational hygiene, environmental impact, safety and economic factors. One of the prime objectives of the Sub Group is to identify the need for the improved availability of equipment, procedures, design, methods, guidance literature and codes of practice so that British manufacturers can take the initiative in designing and supplying equipment.

The survey, funded by the Mechanical and Electrical Engineering Requirements Board, is due to be completed in the Autumn of 1982. The results of the survey will be published by the BMHB and incorporated into a Guide for port operators and all those concerned with ship loading and discharge of a variety of materials, showing them how to ensure the operation generates less dust.

Reader Enquiry Service No. **8217**

Sensor Materials Programme Launched at Harwell

A three-year programme to develop new materials for gas sensors has been established by the Materials Engineering Centre (MEC) at Harwell. The ultimate aim of the programme is to improve industrial safety and process control, and reduce environmental pollution.

At present, the full potential of microprocessors for industrial and environmental control is severely constrained by the lack of suitable gas-sensitive materials for the sensing element. The emphasis of the Harwell programme will be on the development of discriminating, low cost and reliable sensor materials for industrial and process gases such as hydrogen, carbon monoxide, ammonia and oxides of nitrogen and sulphur. Over 200 materials and novel sensor concepts will be evaluated during the 3-year programme.

The research programme is being supported by the Control Electronics and Instrumentation Committee of the DOI's Electronics and Avionics Requirements Board, who will provide 50% financial support for a multi-company sponsored Gas Sensor Materials Working Party. The balance of funds will be provided by member companies who will have exploitation rights in the materials developed under the programme.

The project, which is seen by Harwell as a logical extension of their 5 years of industrial contract R&D on sensors, will be led by Dr. Peter McGeehin of the Harwell MEC. "Some of the materials to be investigated", says Dr. McGeehin, "have already been used in developing sensors for particularly demanding environments, where annual markets of many millions of devices are expected. We believe that the new programme will provide further major commercial opportunities for the UK instrumentation and control industry to exploit these materials in gas sensors".

Reader Enquiry Service No. **8218**

Smaller, Lighter Personal Samplers

A new 'personal' air-sampling instrument for industrial workers, announced by *Casella London Ltd.,* is said to be smaller, lighter and less expensive than any giving comparable flow performance.

Type *AFC 123* samplers have airflow rate adjustable between 1,0 and 2,3 1/min, with automatic flow control to maintain the selected rate constant to within $^+$ 5%. To compensate for build-up of the contaminant being sampled, current-proportional feedback circuits sense increasing demand on the motor driving the pump and adjust motor voltage accordingly. Maximum pressure-drop is 45 cm H_2O; operating temperature range from 10^{o}C to +50^{o}C.

The pump unit clips to the worker's belt or snugly into a pocket, weighs only 460 g and measures 118 x 74 x 44 mm in its tough, impact-resistant ABS plastic case. The pump may be connected to various filter heads for retaining dangerous dusts or fumes, to a miniature cyclone head for isolating the respirable fraction of airborne dust, or to liquid or silica-gel traps for collecting toxic gases or vapours.

The basic motor/pump assembly, a design proved reliable in fifteen years' field service, now incorporates a pulsation-damper. Two LEDs indicate 'pump running' and 'battery low', and a filter in the inlet protects the pump valves if the instrument is started with no head fitted. The nickel/cadmium battery gives running times from 8 to 15 hours at 2 1/min (depending on type of head and contamination levels) before being recharged in situ.

There is also a simpler, less expensive version of the pump, Type *RVC 123,* without the automatic flow control or built-in pulsation damper.

Reader Enquiry Service No. **8219**

CONCAWE study reviews position on SO_2 emissions in Western Europe

In its report, "SO_2 Emission Trends and Control Options in Western Europe", CONCAWE presents an oil industry view of energy and petroleum product trends up to the year 2000, and draws attention to technical and economic implications of potential control options.

The CONCAWE study concludes that potential sulphur emissions from fossil fuel combustion in Europe are unlikely to exceed 1975 levels, and that coal could take over from petroleum as the predominant source of SO_2. Furthermore, the installation of increased conversion capacity in European refineries to meet the demand for lighter products will lead to a considerable reduction in the potential emission of sulphur from petroleum products.

CONCAWE concludes also that the addition of residue desulphurization facilities to European refining processes is not likely to be an economically viable option for reducing mass emissions of sulphur. This is because these facilities require large capital investment, incur high energy penalties, and could become prematurely obsolete with changing trends in petroleum refining patterns.

The 30-page CONCAWE report contains reviews of the health and environmental effects of SO_2 emissions, legislation and regulations relating to sulphur and SO_2 in Western Europe, and various energy scenarios. It discusses petroleum product and sulphur emission trends, and petroleum refining patterns, in some detail, and ends with a review of the major sulphur control options available.

Report No. 1/82, "SO_2 Emission Trends and Control Options in Western Europe", is available from: CONCAWE, Babylon-Kantoren A, Koningin Julianaplein 30-9, 2595 AA Den Haag, Netherlands.

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Reader Enquiry Service No. 8213

Caring for the environment

The Central Electricity Generating Board has received more than 40 Commendations and Awards for environmental schemes at power stations, substations and associated nature trails and field study centres in England and Wales.
They include the Arnold Marsh Clean Air Award, two Prince of Wales Awards, four from the Business and Industry Panel for the Environment, six RICS/Times Conservation Awards and nine Wales in Bloom Awards.

Central Electricity Generating Board

Reader Enquiry Service No. **8214**

CLEAN AIR

VOL. 12 NO. 3

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Reader Enquiry Service No. **8220**

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Contents

Field Comparison of the Relative Efficiency of Two Types of Deposit Gauge
Paul Crossley and *Christopher W. Hill* 91
Pilot's Licence 99
Air Pollution — Reports from Overseas Posts
C.T.H. Stoddart 101
International News —
1982 Stockholm Conference on Acidification of the Environment 103
Divisional News 106
Obituary Mr. L.E. Robson 108
Community Response to Railway Noise 109
Letter to the Editor 110
Reviews — Industrial Air Pollution Control 111
— Environmental Health Report 1981 113
Industrial News 115
The Rotating Disc Gas Scrubber — A New Concept in Air Pollution Control
David Romaine 115

Index to Advertisers

Central Electricity Generating Board cvr.ii
Coalite Group plc cvr. iii
Quality Environment Ltd. cvr. iv

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STEERING IN THE RIGHT DIRECTION

People react in different ways to something which they think might be a hazard in their own lives. One major line of response is to want to know as much as possible about the problem, its impact, what "they" are doing about it, and what the individual can do. The other, negative, response is one that doctors will recognise – "the head in the sand approach". Surveys of blood lead levels in local communities can be hampered as much by this attitude as by the ethical considerations which might make it difficult to permit blood letting amongst children, however good the cause. In spite of the wide publicity given to the possible effects on health of lead, the response will often be: "If I am at risk, or have been affected, I would rather not know" – which might have been elicited by debate on any number of substances.

When the research into a pollutant has been filtered, assessed and rewritten in the form of guidance from the centre to workers in the field, it is most important that essential advice is available to the public directly and in terms that can be readily understood. The recent DOE/Welsh Office Circular on Lead in the Environment has been criticised as too little, too late. Too little, because if its directions to local authorities are taken fully on board, considerable effort and expenditure might be entailed – yet no specific funds have been allocated for this purpose. It is left to local authorities to judge whether the issue overrides other local environmental concerns, in which case they must rob Peter to pay Paul. Too late, because more than eighteen months have elapsed since the DHSS Working Party reported; the issue has become hot public property and meanwhile councils have been under considerable pressure to take action locally. As for giving advice directly to the public, that has been ignored. It would be a wasteful duplication of effort for every local authority to produce their own public information leaflet on lead, so, in fulfilment of its aim to educate and inform, the NSCA has produced 'Lead and You – Reducing the Risks'. This deals simply and concisely with all aspects of lead in the environment, is applicable to all areas of the UK, and it is inexpensive. We hope that it will meet a very obvious need.

FIELD COMPARISON OF THE RELATIVE EFFICIENCY OF TWO TYPES OF DEPOSIT GAUGE

by

Paul Crossley and **Christopher W. Hill**

Environmental Protection Section

Department of Environmental Health, Cleansing & Transport — Leeds City Council

INTRODUCTION

Information on the deposition of atmospheric particles can be of great importance in air pollution studies. Deposited matter is generally regarded as greater than 20 microns in diameter [1], consequently it is not capable of penetrating deep into the respiratory system [2] and therefore will present relatively low danger via inhalation. However, deposition of pollutants may represent a health hazard by other indirect routes e.g. by uptake in the food chain. Additionally dust deposition can be a serious nuisance. One example of this which has often been quoted is that of dust from around opencast mine works, and indeed the relationship between nuisance value of deposited dust and the area of a clean surface covered by the dust has been investigated [3].

The measurement of deposition rates is usually made using a network of deposit gauges. The most common type of gauge used in this country is the British Standard Deposit Gauge (BSDG). British Standard 1747 Part 1. Over 450 of these gauges are being used throughout the UK and its design has remained unchanged for virtually sixty years.

Recently the International Standards Organisation gauge (ISOG) [Draft Standard DP 22] (see Fig. 1) has been used more frequently and in greater numbers.

As in all air pollution studies, where two different types of instrument are used, there may be difficulty in comparing the two sets of results. Wind tunnel studies of both types of deposit gauge have been undertaken by Warren Spring Laboratory (WSL) [4]. These were carried out on one third size models of the actual gauges and indicated some of the limitations of their use. Whilst it is obviously important to know the relative efficiencies of gauges under laboratory conditions it is their behaviour in the field which is of prime importance.

It was shown by WSL that the BSDG is prone to strong secondary air flows within the gauge itself. This leads to serious blow-out of dust occurring at certain wind speeds on the upward side of the collecting bowl. In one earlier study carried out by Lucas it is suggested that about one half of the dust which enters the funnel is liable to be re-entrained before it is washed down into the collection bottle [5]. In practice however this effect will be reduced by the presence of any rain or dew droplets on the inside of the collecting bowl.

Whilst it is true to say that the BSDG is being used less frequently, the Lead Development Association still recommends its use in monitoring around lead works [6]. As part of an extensive survey around a secondary smelter in Leeds, it was decided to examine the deposition rates using both types of gauge mentioned above. Data for approximately two years has been collected.

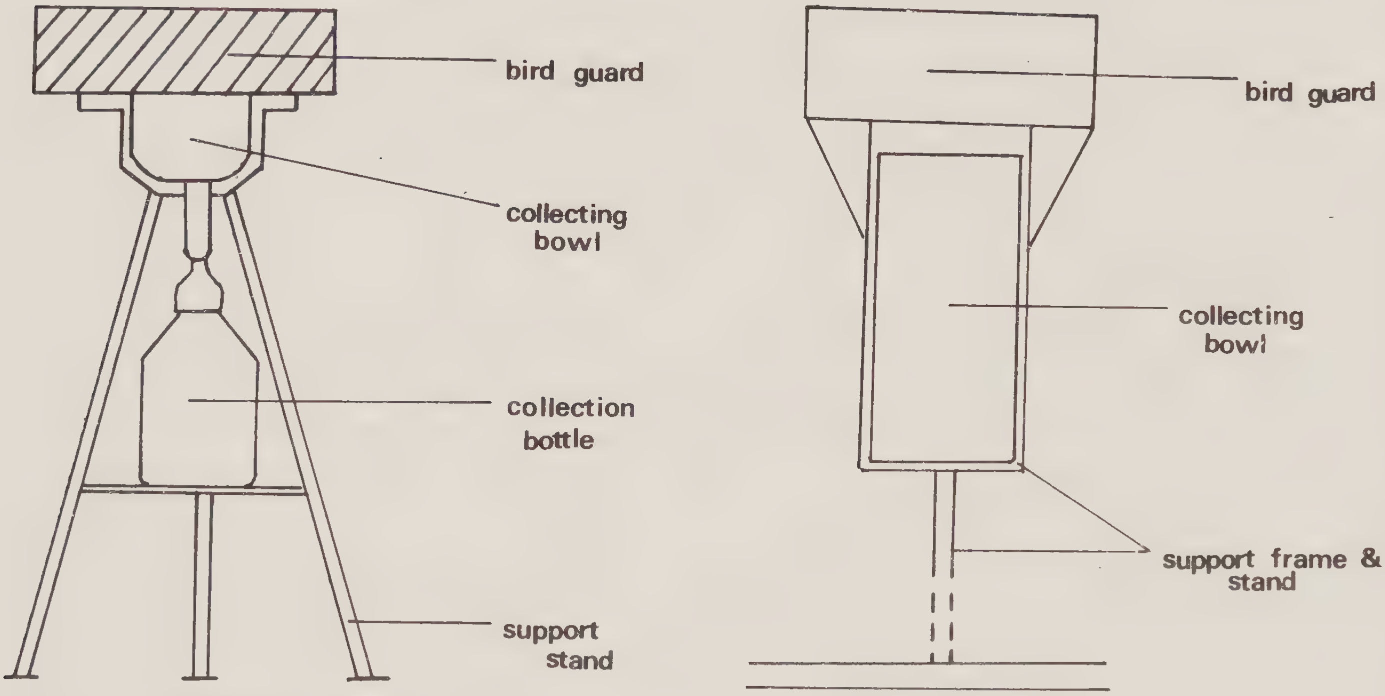

Figure 1. BSDG and ISO Gauges

MONITORING

Deposition monitoring refers to the collection of particles large enough to be deposited as a result of gravitational settling or washout by rainfall. The large sizes of these particles means that they tend to fall relatively close to the emission source. Practical experience has shown that the maximum deposition rates are found in an area approximately 10 effective stack heights downwind from the source [5].

Each consists of an open collecting vessel of known area. The value of the deposition is related to this area and to a known period of exposure, the results being quoted in mass per unit area per unit time. In this case as the monitoring programme was solely concerned with environmental lead the results are expressed in mg Pb m^{-2} d^{-1}. This is the average daily deposition rate for a given month. (Other workers express their results in mass per unit area per month, but this may lead to error if sample collection is not on the last day of the calendar month).

All the gauges were mounted on the flat roofs of low buildings (generally schools) with care being taken to ensure that they were not subject to the aerodynamic influences of nearby structures. Practical experience has shown that it is advisable to secure the gauges to large wooden frames to prevent disturbance by strong winds or vandals.

The gauges were serviced at the end of each month. Any dust which had accumulated on the inside surfaces of the gauge was carefully washed into the collecting bottles using distilled water and a brush. The amount of soluble and insoluble lead in each sample was determined by the county analyst WYMCC using atomic absorption spectrophotometry.

RESULTS

Three sites were selected to monitor deposition using both types of gauge, Carlton and Rodillian being close to the lead works, whilst Tingley was chosen as a 'control site' being some 3km upwind of the works.

Approximately two years' data has been collected but in some cases, because of sampling and analytical losses, twenty four data points are not always available.

The mean value of the monthly deposition rates determined by both types of gauge is given in Table 1.

An example of monthly BSDG and ISOG results at Carlton and Rodillian is shown in Figure 2.

TABLE 1 MEAN DEPOSITION RATES SEPT 79 – SEPT 81 (mg. Pb. m^{-2} d^{-1})

SITE	GAUGE	NUMBER OF SAMPLES	MEAN	STANDARD VARIATION	VARIANCE
Carlton	BSDG	22	0.25	0.13	0.02
	ISOG	24	0.28	0.22	0.04
Rodillian	BSDG	22	0.27	0.16	0.025
	ISOG	21	0.24	0.16	0.024
Tingley	BSDG	22	0.16	0.08	0.01
	ISOG 1	23	0.17	0.11	0.012
	ISOG 2	22	0.14	0.08	0.006

COMPARISON OF BSDG AND ISOG

The information given in Table 1 indicates the degree of similarity between the mean deposition rates determined by BSDG and ISOG at the same sites. At Carlton the BSDG value is 89% of the ISOG, at Rodillian the corresponding figure is 113%, at Tingley (for Tingley 1) 94% and Tingley 2 114%.

Table 2 gives the linear regression analysis between the two sets of gauge at each site; an example of a regression plot is given in Figure 3. The correlation coefficients ranged between 0.30 and 0.47. Statistical analysis of the data using the 't' test for all three sites revealed that there is no significant difference (at the 95% confidence level) between BSDG- and ISOG-determined mean deposition rates.

Figure 2 shows the similarity in peaks recorded for two of the sites. Whilst no clear seasonal trend can be determined the peak in June 1980 is worthy of note. It was recorded by all four gauges in Rodillian and Carlton but no significant peak was found

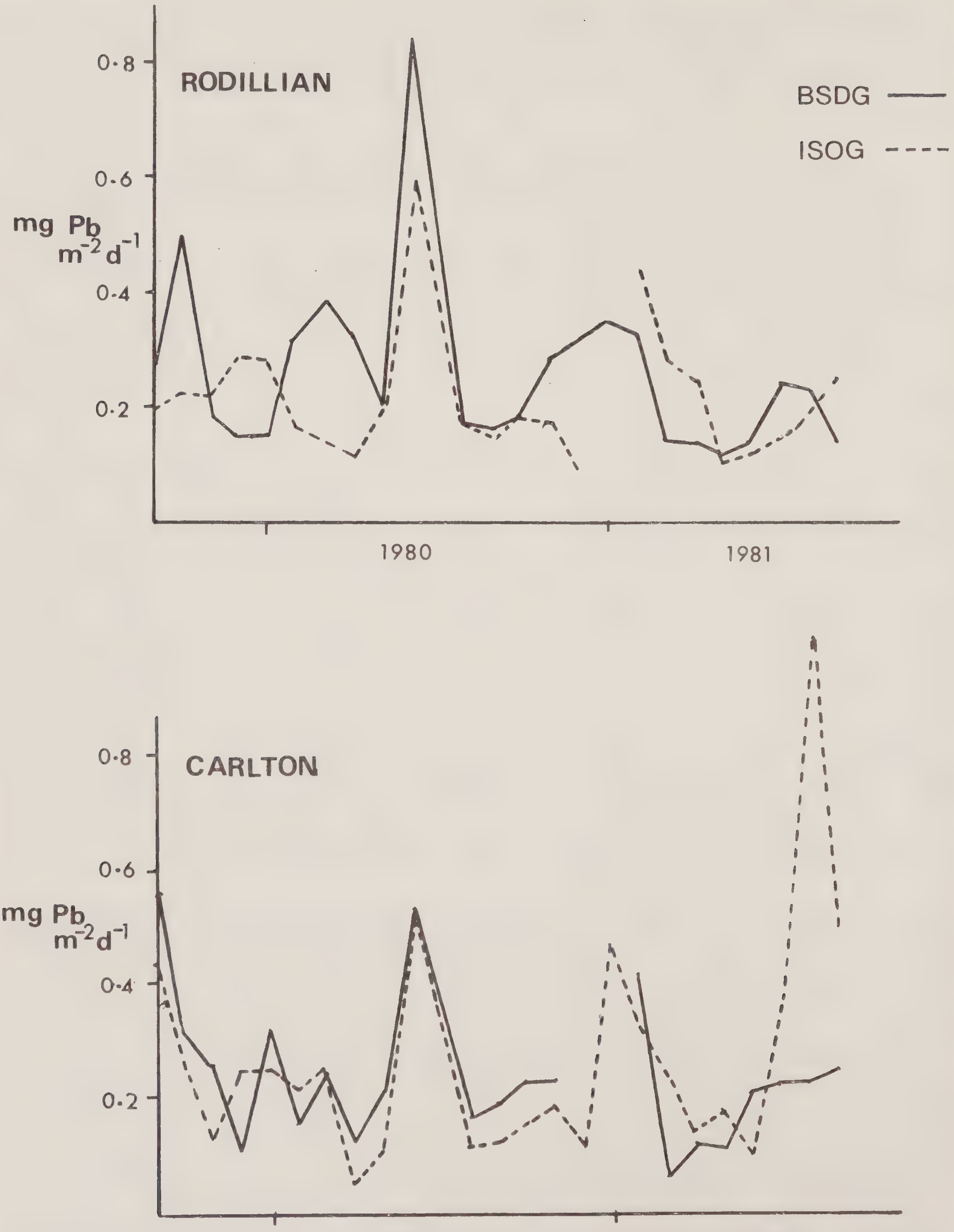

Figure 2. Comparison of BSDG and ISOG monthly results

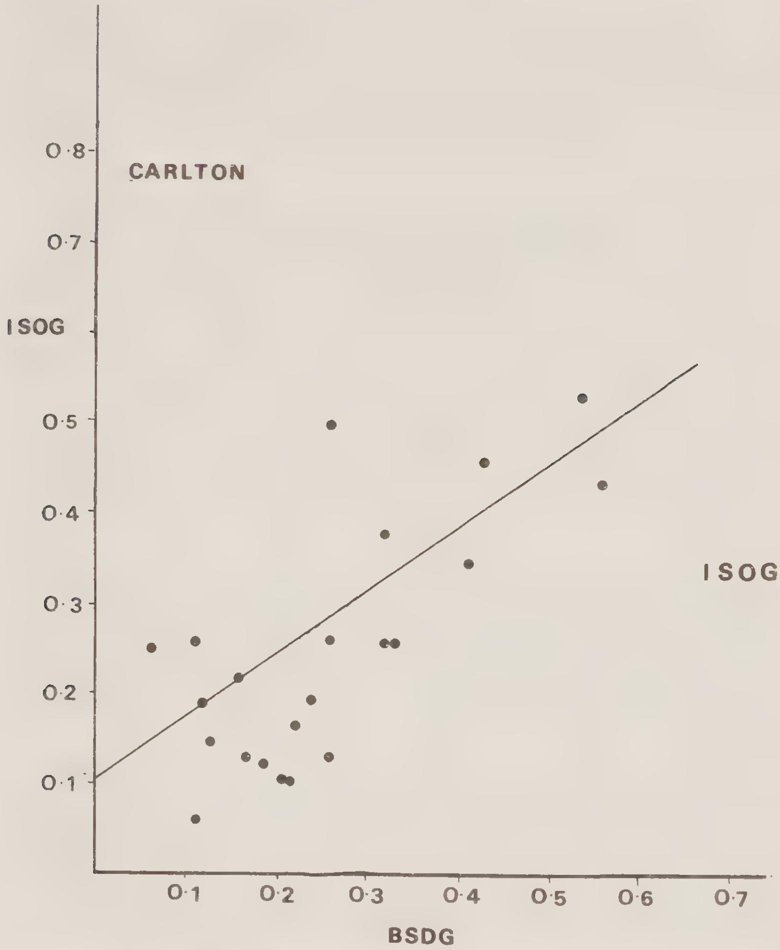

Figure 3. Deposition rates determined by BSDG and ISOG at the same site. mg PB m^{-2} d^{-1}

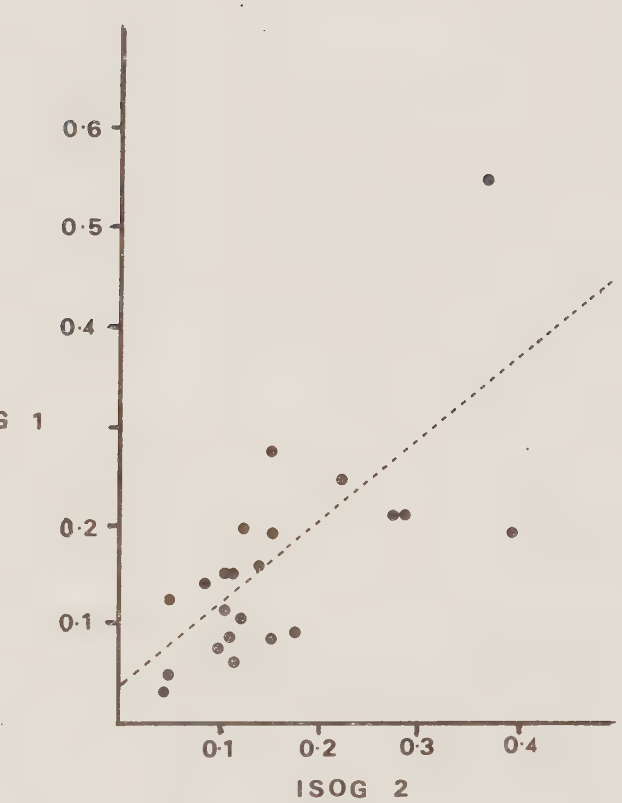

Figure 5. Deposition rates determined by two ISOGs at the same site. mg Pb m^{-2} d^{-1}

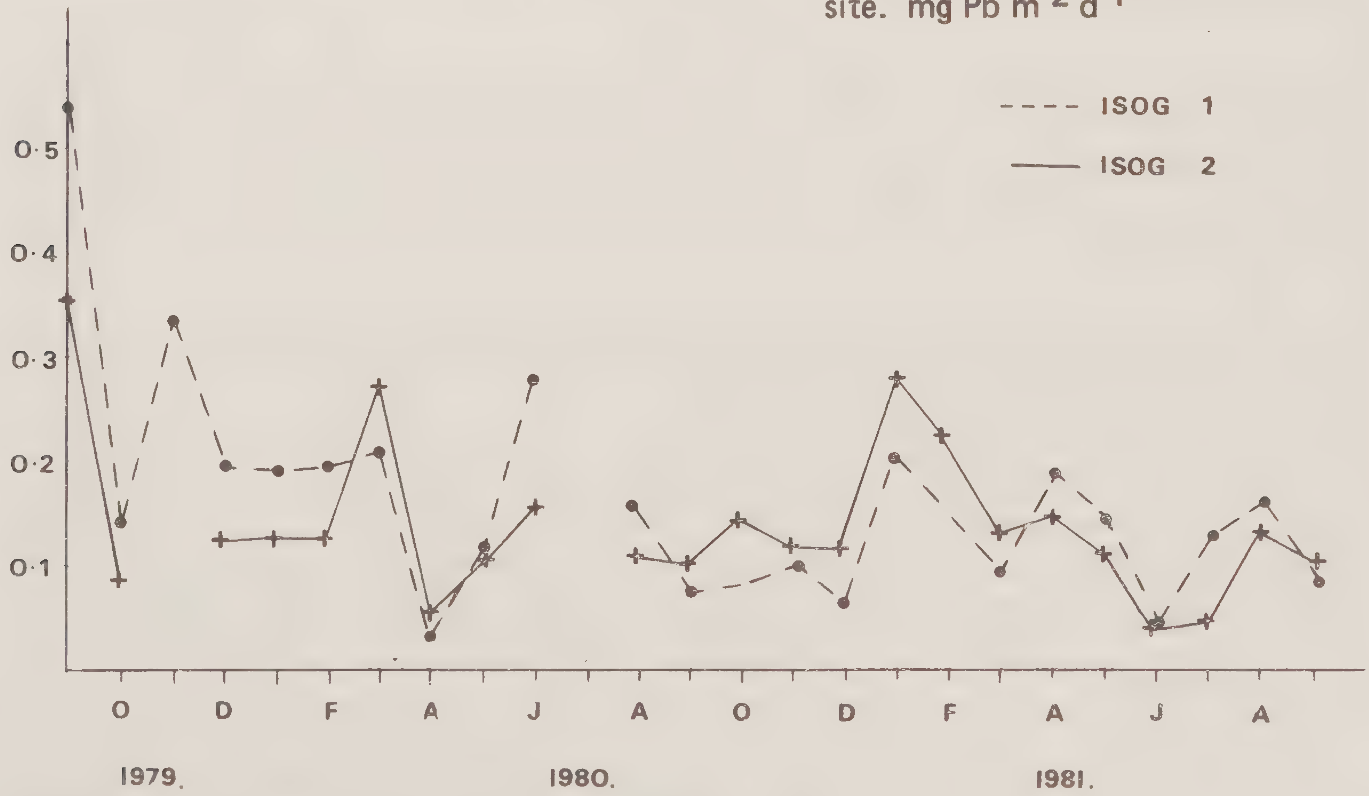

Figure 4. Deposition rates at Tingley. mg Pb m^{-2} d^{-1}

at the upwind control site. From this it is concluded that a works emission was probably responsible for this peak. (This result was essentially confirmed by CERL directional deposit gauges located in the area).

TABLE 2 – LINEAR REGRESSION ANALYSIS OF BSDG AND ISO BY SITE

SITE	CORRELATION COEFFICIENT	SLOPE	INTERCEPT
CARLTON	0.41	0.68	0.11
RODILLIAN	0.41	0.39	0.14
TINGLEY (1)	0.34	0.50	0.09
TINGLEY (2)	0.47	0.49	0.06
TINGLEY MEAN	0.30	0.39	0.09

Although there is some indication that there is a slight downward trend it is not statistically significant and further monitoring will be required to establish this point.

The similarity between the monitoring sites can also be determined from the data given in Table 1. Examination using Fisher's t – distribution revealed that there was no significant difference (at the 95% confidence level) between the Carlton and Rodillian sites as determined by both BSDG and ISOG, but that the Tingley site was significantly different. This is not surprising as Tingley was chosen as a control area which was thought unlikely to be affected by the works.

COMPARISON OF TWO ISOGs

Two ISOGs were located at the same site (Tingley) and operated under identical conditions. Servicing of each gauge was carried out on the same day by one technician. Once the samples were returned to the laboratory they were analysed by the same standard procedure. It was hoped in this way to examine the reproducibility of the results of this type of gauge.

A plot of the monthly deposition rates determined by these two gauges is shown in Figure 4. The best squares correlation co-efficient and best slope and intercept have been calculated and are shown in Figure 5.

The long term mean for each gauge differs by only 18% but this, to a certain extent, masks some large variations during a given month. For example in July 1981 the result for ISOG(1) was more than twice that for ISOG(2). However, analysis revealed that there was no statistical difference between the two sets of results at the 95% confidence level.

CONCLUSIONS

Wind tunnel tests on scale models performed by Warren Spring Laboratory indicated an upper wind speed limit for all horizontal orifice gauges. In addition, 'blow out' of dust which had already been deposited within a BSDG was observed at wind speeds greater than $8ms^{-1}$ for particles 120 um in diameter. If 'blow out' were a serious limiting factor on the efficiency of this type of gauge then a significant difference in deposition rates measured by the BSDG and the ISOG would be expected.

The influence of the wind speeds greater than, say, $8ms^{-1}$ would be largely a matter of chance. It would depend not only on how periods of excess wind speed were distributed throughout the month, but how they were distributed relative to periods of rainfall, humidity and of high dew levels. Obviously if dust in the collecting bowl is washed into the collection bottle then blow-out will not be important. Similarly, dust which dries and adheres to the surface of the bowl may require even higher wind speeds before it is affected.

Warren Spring Laboratory also reported that the wind speed required before blow-out was noticed increased with increasing particle diameter. This would indicate that a knowledge of the particle size distribution is also needed before blow-out can be assessed.

Another factor which might limit the loss of particulate is the nature of the sample itself. For example, large sooty agglomerates tend to be, because of their carbonaceous nature, sticky. They will more readily adhere to the surface of the collecting bowl than will hard spherical particles and hence their loss will be reduced. Present BSDG collecting bowls are made of polythene and it has been postulated [7] that such materials may become electrostatically charged especially during any dry periods of sampling. Thus a further mechanism may exist to reduce sampling losses due to re-entrainment and this may act at times when prevention of loss by wetness of the bowl is at a minimum.

The above points would indicate that, in the real situation, as opposed to the laboratory, blow-out may be impossibly difficult to determine. This does not of itself make the use of BSDG's unsatisfactory. The important question is do the long term results from this gauge differ significantly from those produced by a gauge which does not suffer from blow-out?

This paper contains details of a two year comparison of three pairs of BSDGs and ISOGs where the relative efficiency of the gauges has been calculated in terms of the measured lead deposition rate. At none of the three sites are the mean results from both types of gauge statistically different. Additionally, it has been found that both types of gauge are capable of distinguishing between control and non-control sites.

Two ISOGs located at the same site do not give significantly different deposition rates. The long term means of two gauges differed by 18% which is in broad agreement with the works of Fisher [8] who demonstrated agreement within 15% for identical gauge types placed at the same location.

Whilst it is essential that all atmospheric monitoring programmes are internally consistent, it is also desirable that results should be compatible with those from other monitoring programmes. Only in this way can the national or international pictures of air pollution be determined. The findings presented in this report indicate that long term mean lead deposition rates determined by British Standard Deposition Gauges may be compared with those produced by the proposed International Standards Organisation Gauge.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the assistance of Mr. R.A. Dalley, Public Analyst, West Yorkshire Metropolitan County Council, whose staff performed all chemical analyses; Mr. F. Reynolds, Director of Environmental Health, Cleansing and Transport and Mr. Gittins, Principal Assistant Environmental Health Officer, Department of Environmental Health, Cleansing and Transport, Leeds City Council for their comments and advice given during the preparation of this report.

The ISOG shown in Figure 1 is adapted from LR 235 (AP) with permission of the Director, Warren Spring Laboratory. Crown Copyright (1976).

The views expressed in this paper are those of the authors and are not necessarily those of Leeds City Council.

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PILOT'S LICENCE

— in a streetcar named Desire! If such a mind boggling fantasy ever crossed my mind as we winged our way to New Orleans for this year's meeting of the IUAPPA Executive Committee, it would have been immediately dispelled on landing. Apart from the synergistic effects of an accompanying spouse, advancing years and temperature and humidity in the 90s, the length of the Agenda ensured an appropriate cooling-off in the wintry environment of an overly air-conditioned Hilton Committee room. However, I would not want to give you the impression that it was all work and no play: nor would you believe me if I implied that.

The meeting was most generously hosted by the Air Pollution Control Association (of the United States and Canada) in conjunction with its 75th Annual Meeting and Exhibition held at The Rivergate Centre on the banks of the Mississippi in downtown New Orleans. Flying in from five continents we assembled under our Chairman and President, Dr. Michel Sommer of France, to receive a splendid welcome from the retiring President of APCA, Mr. G. Steve Hart, and members of his Board, and Mr. Gus Von Bodingen, the General Conference Chairman.

Diamond Jubilees are rightly treated as very special events and, just as we are hoping for a big turn out for our 50th Conference in Torquay next year, so I was expecting a large attendance in New Orleans. I was not disappointed. Almost 2000 delegates plus a further 700 or so exhibitors, press etc., is a fair sized gathering even by North American standards. Nevertheless, there was understandable disappointment that recession had reduced numbers substantially below those of previous years. We know the problem! The exhibition included 185 individual stands and virtually filled the central hall which at a rough guess approaches our Birmingham National Exhibition Centre in dimensions. Add to this some 400 papers delivered in 69 separate sessions with up to 8 running simultaneously, and you will appreciate why I was so impressed with the organisation and administration which made it all run so smoothly. In addition to this the plenary opening session of the Conference and a host of other committee meetings (including ours) were held in the Conference Hotel. Nevertheless, I would not want to give you the impression that I let the sheer size of the Conference go to my head. As an avid Dallas watcher I took it all in my stride.

Size apart, NSCA Members would have been entirely at home attending the various sessions which in general covered exactly the same sort of topics, albeit in different degree and from different points of view, as they would be used to discussing at home. For example, the projected increase in industrial coal burn is as basic a topic for discussion in the States as it is in Britain and papers presented ranged across every aspect from fluidised bed combustion to flue gas desulphurisation to the problems of open cast mining. Similarly, road vehicle emissions, heavy metals, monitoring, legislation and control, odour problems and the disposal of toxic wastes, were examined in a series of sessions at which NSCA members would have been eager to add their piece. Of course, all this underlines the raison d'etre of IUAPPA which is to co-ordinate the efforts of the different nations in their common bids to achieve clean air.

As one would expect, not all was sweetness and light. The two keynote addresses of the plenary session provoked quite a few mutterings, at least in my part of the audience. The first speaker, Kathleen M. Bennett, who is the Deputy Administrator for Air, Noise and Radiation in the US Environmental Protection Agency, and is a Presidential appointee, not unnaturally spent quite a lot of time explaining the Administration's approach to the amendments to the US clean air legislation which are currently before Congress. At one point I got a strong emission (it was really a hiss) from behind, to the effect that Democrats were for clean air while Republicans were against it. Obviously this demanded further investigation and at a party very late that night it was explained to me that I must have misheard what was said. The truth was that Republicans were for clean air while Democrats did not really understand the problem. However, said my advisor, I should appreciate that things were somewhat more complicated than that because some Republicans would be voting for certain Democratically inspired amendments while there was also a number of Democrats who would be voting with the administration! When I finally decided that I had the measure of the situation I went off to bed feeling quite pleased with my newfound grasp of American politics. Alas ...... the dawn!

On the other hand the second Keynote speaker, The Honourable John Roberts, Minister for the Environment, Canada, was absolutely clear where he stood — being firmly against acid depositions reaching Canada from anywhere south of the border as well as all those Democrats and Republicans who were apparently unwilling or unable to stop them. Measured against the pH scale, and as best I could estimate it, this address scored somewhere between 2 and 3. In view of this it was interesting to note that Kathleen Bennett got much the same message from the Swedish Conference on acid rain which took place in Stockholm the following week. It is only fair to add that the British Ministerial delegation to that forum experienced exactly the same reception! So John Clarke, our Immediate Past Chairman of Council, was on the mark when he predicted last year that 1982 would be "the year of acid rain".

Well, the APCA Conference was an altogether first class event and I felt very privileged to have been associated with it. You will be pleased to know that our IUAPPA Meeting was also a good one. One outcome is that I can pass on the inside information that APPA has received nearly 460 proposals for papers to be presented at the 6th World Congress on Air Quality in Paris between 16 and 20 May 1983. That too promises to be an outstanding event with at least 24 countries participating. The second announcement of the Congress giving full details will be circulated shortly.

Finally, I should tell you that before leaving New Orleans I did see a streetcar en route to Desire — but the accompanying spouse, advancing years and temperature and humidity in the 90s decreed that I should stay in my air conditioned bus.

John Langston
Secretary General

AIR POLLUTION – REPORTS FROM OVERSEAS POSTS

C.T.H. Stoddart

Overseas Technical Information Unit, Department of Industry

Air pollution and its damaging effects on health and the environment continues to be a matter for concern across the world. A series of reports from the UK Counsellors (Science & Technology) and their staff in British Embassies and from British Council Science Officers describes the ways in which the problem is being tackled in their host countries. While many of the air pollution problems such as those caused by emissions from urban traffic, power stations and industrial processes are common to all countries, each individual country has its own particular concerns dictated by its climate, geography and economic situation.

In the approaches adopted it is very much a matter of finding an appropriate balance. The balance is between ensuring clean air with a congenial environment and the need to accommodate industrial manufacture and the movement of goods and people to support a modern, material standard of living. This is often reflected in the balance required between strict legislation and controls based on rigid standards of emission levels enforced without exception, which could seriously inhibit economic growth and development, and legislation allowing too many qualifications and exemptions which could be open to abuse and ineffective in controlling air pollution. There is a balance also in the share of responsibility between central and local government.

Basic to the successful enforcement of the proper legislation is effective monitoring both of emissions at source and also of air quality. The establishment of nation-wide monitoring networks and the development of instrumentation are notable features. Moreover, the existence of a body charged with the duty of enforcement is a prerequisite for success.

The international aspects of air pollution control have been emphasized increasingly with studies of the long-range transport of pollutants across frontiers which have led to international agreements. At the present time the major concern relating to long-range transport is the contribution of sulphur oxides and nitrogen oxides to the acid rain problem. In addition to the sulphur and nitrogen oxides, transportation of new pollutants such as lead, cadmium, mercury and chlorinated hydrocarbons has been recognised. Pollution of the Arctic and Antarctic regions by long-range transport has also been observed. Global dispersions of organic compounds are very persistent and can have carcinogenic and mutagenic effects even in very low concentrations. The effects on human health, crops and the natural environment of chronic exposures to low concentrations of a variety of air pollutants are still largely unknown and require investigation.

Air pollution themes which continue to receive attention include photochemical smog formation and the effect of chlorofluorocarbons in the upper atmospheric ozone layer. Recently the significance of interactions between pollutants has been recognised and studied. The fact that air pollution levels, of particulates and organic vapours for example, can often be higher indoors in the home and office than in the surrounding environment has now been realised and investigated in relation to energy-saving and ventilation. Attention has now also been drawn to the possibility of a future change in the earth's climate due to increasing emissions of carbon dioxide.

Air pollution is seen to be a complex problem not only technically but also in the interrelationship of environmental, social, economic and political factors. The recognition of this interrelationship in each country is important and solutions are being found through careful urban planning and redevelopment and imaginative regulations which provide the necessary incentive for more efficient and cost-effective means of control.

The reports, entitled Air Pollution, Reports from Overseas Posts, Technology and the Environment no. 12, 1982, are being issued in four parts:

Part 1 Europe – France, Germany, Italy and a comparison outline of the United Kingdom
Part 2 Europe – The Nordic Area
Part 3 Japan, USA and USSR
Part 4 Australia and the Third World including Argentina, China, Colombia, Egypt and Saudi Arabia

Part 1 is now available.

The reports may be obtained, free of charge by application on official letterhead to:

Overseas Technical Information Unit, Department of Industry, Abell House, John Islip Street, London SW1P 4LN. Tel: 01-211 6297.

LEAD AND YOU

Reducing the Risks

The National Society for Clean Air has produced a public information leaflet on Lead describing the problems caused by lead pollution, detailing current controls, and giving advice on reducing personal/family exposure to lead.
The A5 six page leaflet costs 25p per copy, £2.00 per hundred or £15 per thousand copies (discount of 10 per cent for orders in excess of 5000). Prices are inclusive of post and packing.
A sample copy of the leaflet is inserted in this issue.
Available from:
NSCA, 136 North Street, Brighton BN1 1RG. Tel: Brighton (0273) 26313

Please enclose remittance with order. Reader Enquiry Service No. **8223**

INTERNATIONAL NEWS

An IUAPPA Publication

1982 STOCKHOLM CONFERENCE ON ACIDIFICATION OF THE ENVIRONMENT

A first version report on the above conference has been published and sent to all Signatories to the ECE Convention of Long Range Transboundary Air Pollution and to other participants in the Conference.

The Stockholm Conference was in two parts, with a week of Expert Meetings followed by a Ministerial Conference (June 28 - 30). The first version report contains a summary of the major findings and conclusions of the two meetings of experts, and short summaries, prepared by the national delegations, of the statements made by the Ministers and Heads of Delegations. The full statements will be published in the final version of the report which is due for publication in a few months' time.

CONCLUSIONS OF THE EXPERT MEETINGS

Two meetings of over 100 experts from Europe and North America were held, the first discussing ecological effects of acid deposition (aquatic and terrestrial ecosystems) and the second discussing strategies to control emissions of sulphur and nitrogen oxides from stationary sources. The major findings and conclusions were presented by the meetings' Chairman, **Goran Persson,** of the National Swedish Environment Protection Board.

The experts failed to endorse a limit value for sulphur deposition of 0.5 g S m^{-2} yr^{-1}, which had been urged by the Swedes. The experts also came to no firm conclusions on a strategy to control emissions of sulphur and nitrogen oxides. They considered that there was a need to establish clear goals for a reduction in emissions, but that the ways and means should be decided within the framework of the ECE Convention. If the Swedes had hoped to pre-empt the ECE Convention talks by securing firm commitments from Signatory nations' ministers and government officials at Stockholm, they were disappointed.

While in general the experts were covering old ground in the light of the latest available information, and trying to come to some consensus of opinion, a new dimension to the debate was added by **Prof. Bernhard Ulrich's** work on the effects of acidic pollution on terrestrial life. Ulrich's investigations into the effect of acid deposition on soils and forests suggest that tree growth may be decreased in association with annual mean concentrations of SO_2 now prevailing in large parts of Europe (as low as 25 - 50 µg SO_2 m^{-3}, which include episodes with more than 100 - 200 µg SO_2 m^{-3}).

The experts concluded that: "Concentrations of SO_2 considered to cause damage are smaller than was previously thought because physiological and biochemical changes of significance to growth may occur without the development of visible damage. The recently reported forest damage in an estimated 1 million hectares of central Europe seems to be related to (among others) the direct effects of gaseous pollutants and soil impoverishment, and toxicity arising from very large amounts of wet and dry deposition."

The working group on atmospheric processes pointed out that changes in the rate of oxidation of SO_2 to sulphate brought about by changes in the concentrations and interactions of e.g. NO_x and hydrocarbons will lead to changes in the relative proportion of SO_2 and sulphate and thereby to changes in the sulphur deposition pattern. Thus, controls might have to be directed at sources of NO_x and hydrocarbons (including road vehicles) as well as at SO_2 emissions.

THE CONFERENCE OF MINISTERS

The Conference, which was opened by **His Majesty the King of Sweden,** heard an opening statement from **Mr. Anders Dahlgren,** Swedish Minister of Agriculture, in which he pressed all Signatories to the ECE Convention that have not yet ratified it to do so as soon as possible. He said that the Convention has to be given the necessary force and power, so that a gradual reduction of emission of air pollutants within the ECE region could be achieved. Mr. Dahlgren pointed out that such measures are no longer in the interests of the Scandinavian countries alone, but are of international concern, with economic and ecological benefits for all countries.

Statements were made by representatives of UNEP, ECE, OECD, WMO and WHO. In his statement, **Dr. Mostafa K. Tolba,** Executive Director of UNEP, stressed that many changes had occurred since the 1972 UN Conference on the Human Environment in the way that man perceives his environment. In particular, he emphasised the emerging belief of nations that the atmosphere and other life-support systems can no longer be taken for granted.

Mr. James MacNeill, Director of the Environment Directorate of OECD, concentrated in his statement on the costs of controlling emission of SOx and NOx. The issue, he said, is no longer primarily a technological one. Reliable technologies exist commercially and new methods for pollution control are being developed to increase efficiency and lower costs. Rather, the issue is an economic one, raising the question of how much control can be considered as cost-effective. The major component of costs is flue gas desulphurisation, which OECD estimated to be in the region of 15 per cent of the total cost of generating electricity in a coal fired power plant. When the cost of other major environmental controls are added this percentage increases to 20 per cent. He felt that while these costs are significant, and make the question of appropriate level of control an important one, they do not generally jeopardize the competitive position of coal.

The debate among Ministers and Heads of national delegations was characterised by statements of worthy sentiment rather than intent. Calls for international co-operation were the keynote. Belgium's Secretary of State for Public Health and Environment, **Mr. F. Aerts** stuck to the principle that all countries are free to determine their own strategies for emission control and energy policy, and outlined Belgium's tactics, which will involve the introduction of new regulations on emission and immission norms. **Mrs. K. Bennett,** of the US EPA, outlined the research effort and findings to date in the US, ending on an optimistic note " ... we remain confident that even the most difficult environmental problems will be resolved through the application of human initiatives, ingenuity, and the will to address these concerns in an open-minded and technically sound manner."

Mr. Giles Shaw, MP, Parliamentary Under Secretary of State for the Environment, UK, also stressed the "large research programme" maintained by his country. There were, he said, no plans to build new fossil fuel power stations in the UK "but if any plants come forward, pollution control would have to be considered on the basis of best practicable means." Best practicable means are almost certain to include methods of reducing sulphur dioxide emissions, according to what the UK's Chief Alkali Inspector, **Dr. Leslie Reed,** told the House of Lords Selection Committee on the European Communities on 25 May, 1982.

Mr. Shaw declared that, given the costs and energy penalties, it would be difficult to justify further controls on existing facilities unless a commensurate environmental advantage was certain.

Other countries, however, were ready to propose targets for reducing emissions. West Germany's aim is a 50 per cent reduction in SO_2 emissions by 1985. Denmark's Minister for the Environment, **Mr. E. Holst,** pledged his country to reducing the level of SO_2 emission (which has remained steady in spite of constantly increasing energy production in the 1970s). He said that Denmark is also willing to pay the necessary costs connected with such a reduction in accordance with the Convention.

Work is now going ahead under the ECE Convention in preparation for the first meeting on abatement strategies in early 1983. The Stockholm meeting has prepared the ground for the intensive co-operative effort that will be involved, and if the polluter pays principle has not yet been firmly endorsed on an international basis, what did emerge from Stockholm was a more conciliatory line from nations considered to be the major polluters (notably the UK) and a positive eagerness for action from the other participants.

CLEAN AIR SOCIETY OF AUSTRALIA AND NEW ZEALAND

Eighth International Conference, Melbourne, 6 - 11 May 1984

CASANZ have announced an extension of time for submission of abstracts (Ref. CALL FOR PAPERS insert in last issue of *Clean Air*). Subject to receipt of notice of intent to deliver a paper, and an indication of the likely subject matter, by 30 November 1982, abstracts may be submitted **up to 31st March 1983.** The final date for submission of papers remains at 30th September 1983.

MICHAEL FOOT BECOMES NSCA VICE-PRESIDENT

The Rt. Hon. Michael Foot, MP, was elected Vice President of the National Society for Clean Air at the Society's AGM held in Llandudno on 18 October. Mr. Foot had previously agreed to the nomination, which was made by Cllr. J.R.P. Evans of the NSCA's South and Mid Wales Division. Mr. Bernard Twyford expressed the Society's pleasure at Mr. Foot's acceptance of the honorary office (which is held for a period of three years) and said that his support would be invaluable.

DIVISIONAL NEWS

NEW HON. SECRETARY FOR FOR YORKSHIRE AND HUMBERSIDE DIVISION

Mr. Bernard Twyford, who was elected Chairman of the NSCA at the Society's AGM in Llandudno October 18, has for many years given unstinting service to the Yorkshire and Humberside Division, both on the Divisional Council and as Hon. Secretary. As members will know, hon. secretaries play a tremendous part in progressing the Society's aims by co-ordinating affairs at regional level and arranging meetings and other activities. As Chairman of the Society, Mr. Twyford faces a year of intense commitment to the NSCA as a whole, which was preceded by a year as deputy chairman, and his active role will continue as Immediate Past Chairman. The Yorkshire and Humberside Division decided, therefore, that in order to free Mr. Twyford of some of his responsibilities, it would be wise to appoint a new hon. secretary. The Divisional Council was delighted when Mr. David Bird of Sheffield City Council's Environmental Health Department accepted the nomination. He was duly elected and took office in June of this year following the Division's annual general meeting.

Those wishing to contact Mr. Bird should write to: Environmental Health Department, Sheffield City Council, 1 Barkers Pool, Sheffield S1 1EN. (Telephone: 0742 734653).

EAST MIDLANDS DIVISION

Report of a meeting held at the Festival Halls, George Street, Corby on 1st April 1982.

The meeting at Corby on 1st April 1982 was the third held there during the Division's almost 33 years in existence. Attendance, at 56, was very good and as members arrived, they were served with coffee, kindly provided by our hosts, the Chairman and Members of the Corby District Council.

Opening the proceedings, the Chairman of the Division, Mr. C.W. Stacey DFC, introduced Councillor R.J. Ogilvie, Chairman of the Corby District Council, who extended a Civic Welcome to the delegates and said that since the Division's last visit, Corby had taken on a new skyline marked by the absence of the yellow smoke which had been so prevalent in the past. Mr. Stacey thanked Councillor Ogilvie for his welcome and then proceeded with a short business meeting. Mr. Stacey then introduced in turn Mr. A. Myles, Sales Manager of Computer Engineering Ltd, and Mr. A. Rudge, Research Officer with the British Steel Corporation.

Mr. Myles and Mr. Rudge gave papers on aspects of noise, the one by Mr. Myles being on "Noise in the Workplace" and the one by Mr. Rudge on "Noise from tube making – British Steel Corporation". Both papers were most informative and extremely interesting and the Division is indeed grateful to these two speakers for giving of their time and expertise and for assisting in making this such a helpful and successful morning. Evidence of the interest in the papers was indicated by the need to conclude the questions and discussion, in order to adjourn for lunch.

Corby District Council generously provided an excellent lunch which all present thoroughly enjoyed and thanks are due not only to the Corby District Council, but also to their staff who had been at pains to provide such an attractive meal.

In the afternoon the delegates formed themselves into two parties, one of whom was conducted round the British Steel Corporation Tubeworks, whilst the other party visited the Golden Wonder Potato Crisp Factory. Again, the Division is indebted to the two firms concerned and also to members of their staffs who acted as guides for those visits.

Clearly, a great deal of work and effort had been put into the arrangements for the day by the staff of the Corby Environmental Health Department, in particular, Mr. R.A. Sargent.

E.F. Raven
Hon. Secretary

NORTHERN DIVISION

Annual General Meeting

The Annual General Meeting of the Northern Division was held in Newcastle upon Tyne on Friday, 2nd July 1982. 49 members attended and heard the Chairman, Councillor Poole, report that membership had remained fairly steady over the past 12 months and that the usual three meetings held in the year had all been well attended. Congratulations were extended to Councillor Yellowley, Vice Chairman, who had been elected Lord Mayor of the City of Newcastle upon Tyne and to Councillor Hodgson, elected Mayor of the Borough of Stockton-on-Tees.

The Secretary General, Air Commodore John Langston, reported upon the activities of the General Council, making particular reference to the interesting programme that had been lined up for the Annual Conference at Llandudno.

The meeting closed with an interesting and informative talk by Dr. Peter Caunt, a member of the Central Electricity Generating Board's Scientific Services Department, on the Board's activities to reduce air pollution. Dr. Caunt described the monitoring carried out in the vicinity of Drax and Eggborough generating stations both before and after commissioning and the variety of instruments used to measure smoke, sulphur dioxide, grit, dust and trace elements. He dealt with questions on the sampling of flue gases for grit and dust, the problems associated with firing wet fuel, acid rain, the disposal of fly ash, etc.

Dr. Caunt was thanked by Mr. E. Soady, Director of Public Health, Sunderland M.B.C., who was pleased to note that the Board was not complaisant and that research was continuing.

C.R. Cresswell
Hon. Secretary

OBITUARY

L.E. (Ewen) ROBSON

Ewen Robson joined Local Government in 1962 as a student public health inspector and spent the whole of his 20 years in the service in his native City of Bristol. After studying at the Bristol College of Technology he qualified as a Public Health Inspector in 1966 and was immediately appointed as a District Inspector in the Bristol Department. After further study he obtained the Diploma in Air Pollution Control and in 1969 was appointed to a senior post in the Department with responsibility for air pollution and noise control. In November 1973 Ewen was appointed an Assistant Chief Environmental Health Officer in the new Environmental Health Department of the Bristol City Council.

Since 1969 Ewen specialised in air pollution and noise control and in that field he served his City and his profession with distinction. A Member of the Institution of Environmental Health Officers, the Royal Society of Health and Institute of Acoustics and an Associate of the Institute of Energy, he was an active and committed member of his profession. He also had a special interest in training and was much in demand as a lecturer both in Colleges and Universities and also for the South West Provincial Council. He served on a number of Working Parties, including the Working Party which reviewed Noise Insulation Grants.

Ewen was a very active and enthusiastic Member of the National Society for Clean Air, serving on its South West Divisional Council and representing the South West Division on the Council of the Society. After serving as Vice-Chairman, he became Chairman of the Society's Parliamentary and Local Government Committee in 1981.

Ewen was a much respected senior officer and greatly valued member of the Bristol Environmental Health Department and will be remembered with affection by his many colleagues and friends.

A Tribute by D.J. Barnett, MBE, Chairman of the NSCA's South West Division

It was a great shock when I learned of the sudden and untimely death of Ewen Robson who had been a close colleague and friend over many years. Ewen represented Bristol City Council on the South West Division for some 12 years and had been a Member of the Divisional Council for the whole of that time. He served as Assistant Secretary to the Division for many years and for the last 8 years had been one of the Division's representatives on the Council of the Society. During the whole of our association with the South West Division Ewen was one of the driving forces in the work of the Division and his energy and enthusiasm has been a major factor in its success. More recently as a Member of a small working party he played a key part in determining the future direction of the Division, the benefits of which have been seen very quickly and which I believe will prove to be something of a watershed in the history of the Division.

His professional achievements are many and well known. What is more important is the deep sense of loss which all the Members of the South West Division must now feel. In addition, my colleagues on the Divisional Council have lost a good friend and a trusted and greatly respected colleague. It was a privilege to have known and worked closely with Ewen.

Don Barnett

COMMUNITY RESPONSE TO RAILWAY NOISE

A planning appeal, based on the 55 dBA Leq 24 hours yardstick, has been decided in favour of Rugby Borough Council. The proposed housing development on land near the main Euston to Manchester railway line at Shilton would also have been subjected to unacceptable vibration. The Department of the Environment inspector — Mr R E Watson — made the following observations in his report:—

"The noise surveys carried out independently by both parties obtained almost identical results, and pointed to the conclusion that the noise level at any point on the site would be unlikely to exceed 57 or 58 dBA Leq (24 hours). The council argued that this would significantly exceed the level of 55 dBA which they normally use as a guide for judging the suitability of sites for residential development, and this is based, to some extent, on a European Community study of noise. On behalf of your clients it was argued with reference to detailed research that in relation to railway noise the overall exposure level should not exceed 60 dBA.

The council also contended that vibration from passing trains would also seriously affect the new development. Comparisons were made between the readings obtained at the appeal site and those made on an existing residential area adjoining a railway line elsewhere within Rugby. On this site by means of interviews the council obtained a subjective response to the vibration effects which indicated that they were considerable. The results showed that the appeal site received higher vibration levels than the other site studied, and the council, therefore, concluded that a significant proportion of residents on the appeal site would be likely to respond unfavourably to vibration.

A detailed response was not made at the inquiry to the council's arguments on this issue. I note that the provision of earth embankments and other acoustic screening measures would be unable to lessen the problem of vibration. From the evidence put before me by the council I conclude that vibration effects would substantially harm living conditions within the proposed development. In my judgement the combined effect of vibration and noise would make this site as a whole unsuitable for residential development, and I feel that this would be unacceptable."

LETTER TO THE EDITOR

Roadside Monitoring of Smoke and Sulphur Dioxide

1. I read with some disquiet the brief note on the above topic in the most recent issue of "Clean Air" (Vol 12 No. 2). Although the proposal to encourage more extensive roadside monitoring was discussed at the meeting of the NSCA Technical Committee on 5 March 1982, and I therefore fully expected the appearance of a note in "Clean Air", the published version is misleading in terms of interpretation of the EC Directive and of availability of data on roadside smoke concentrations.

2. Firstly, the note appears to take for granted that the EC Directive applies to the roadside and therefore that the UK smoke and SO_2 network fails to meet the requirements of the Directive. What the Directive actually states is that the measuring stations "must be located at sites where pollution is thought to be greatest and where the measured concentrations are representative of local conditions." There is no doubt that this statement is open to a variety of interpretations but throughout the negotiations on the Directive it was my very clear personal understanding that Member States were interpreting "representative" and "local" in the context of the general atmosphere in a town or conurbation, or significant part thereof, and *not* in the context of very local, relatively small spatial scale, situations such as the roadside or kerbside. Furthermore, subsequent to negotiations being concluded in 1980 I have not been aware of any suggestions to the contrary by representatives of Member States. There appears to be a consensus among the Member States that we should first resolve any larger scale problems of implementing the Directive. Should there ever be a change in interpretation of the Directive such that the kerbside situation is specifically included then of course some kerbside monitoring would be required.

3. My second point concerns the final sentence of the first paragraph of the note which is not correct. There have been publications by the Warren Spring Laboratory of relevant work undertaken on behalf of the Department of the Environment. Information has been available for some 20 years, beginning with published work by WSL in the early sixties which clearly demonstrated the influence of motor vehicles on

kerbside smoke concentrations. More recent available data on smoke includes my paper on vehicle pollution to the NSCA Workshop at the University of Warwick in April 1979 and a series of published WSL reports on measured kerbside pollution levels. Some of the data are also summarised in the NSCA booklet on "Pollution from Road Vehicles." Typically at the present time, in areas where smoke control programmes are largely complete and therefore general urban smoke concentrations are relatively low, kerbside concentrations of smoke are up to 3 times those at non-kerbside locations but decrease rapidly with distance from the kerbside.

4. Implementation of the Smoke and Sulphur Dioxide Directive is a new venture for all who are concerned with air quality and with the costs of maintaining an acceptable environment. There will be much to learn and it is important not to begin with misunderstandings.

A.W.C. KEDDIE
Head of Air Pollution Division
Warren Spring Laboratory

INDUSTRIAL AIR POLLUTION CONTROL
Recession helps clean air, but outlook poor

The latest report of the Chief Alkali and Clean Air Inspector, for 1981, was launched recently at a London Press conference. This move was designed, said Chief Inspector Dr. Leslie Reed, to increase public awareness of the Inspectorate's role in the control of industrial air pollution and to overcome the charge of secrecy in the conduct of its affairs that has been levelled at the Inspectorate in the past. Dr. Reed reported on what had been a gloomy year, with a marked decrease in industrial activity. He warned that Britain's ageing industry will, as time goes by, find it increasingly difficult to maintain existing clean air standards. In the meantime, he said, reduction in output, resulting in the closure of older and less efficient processes, has reduced emissions to atmosphere. Problems are anticipated if and when dormant plant is reactivated after a prolonged period. Pollution could arise from e.g. lack of maintenance, an area where short-term cash savings can be made.

The Inspectorate received few proposals for new registrations during the year. Inspectors made, on average, one visit each per day (a total of 13,839, with an additional 842 visits made by sampling teams).

The report has a new format this year and reviews only the following processes: amine works, ceramic, chemical incineration, electricity generation, gas and coal, iron and steel, lead, mineral and petroleum works. More detailed accounts of other industries under the Inspectorate's control are covered in 15 separate district reports. A complete list of numerical emission limits (presumptive limits) applicable to scheduled processes is published in the report, together with a special article on the interpretation of best practicable means. A topic of importance in this context is the relationship between the historical use of BPM and the newer commitment to air quality standards. The report states that the AQS concept simply formalises what has always been the aim of BPM, namely an acceptable environment. "AQS and BPM are therefore perfectly compatible, indeed complementary, in nature." In any given situation, says the report, the requirements of both BPM and AQS should be met; the concentration of any pollutant should be kept as low as is reasonable practicable and it should be recognised that AQS's are not licences to pollute up to a given level.

A second article on pollution by sulphur dioxide refers to the international dimension of the inspectorate's work and to the EC directive on smoke and SO_2.

The number of complaints received from the general public in 1981, 339, was similar to those recorded in 1980. The greatest proportion was made against cement, metal recovery, smelting, chemical manure (fertiliser), coke and petroleum works, with smell playing an important part in the latter case.

Over half of the 69 infractions of the 1906 Alkali Act were against cable burners, with a large number against registered mineral works (about which Dr. Ellis from ACAI, Manchester, spoke at the recent Clean Air Conference). 17 prosecutions were taken during 1981, 15 of these against cable burners. Fines and costs totalled a little over £2000, which the report called a "derisory figure" in comparison with the profit to be made from illegal cable burning. At the press conference, Dr. Reed made clear his feeling that it was more appropriate for local authorities, via their Environmental Health Departments, to control cable burning and he expressed the hope that this would happen soon.

7 improvement notices were issued to 2 works, Anzani Asphalt Limited and National Smokeless Fuels Limited (Phurnacite plant). This plant, says the report, "continues to disappoint" — as members of the Society and readers of this journal will be weel aware. The NCB and the Government were approached for money for new investment in the recommended Ancit process but the request was turned down and the Inspectorate confirmed that many aspects of the 30 year old plant's operation could no longer be regarded as meeting BPM. Consequently, a £4 million remedial programme was required by the improvement notices.

Referring to lead works, the report stresses the importance of a comprehensive integrated policy for the control of low level uncontained sources (fugitive emissions) in general, rather than a piecemeal approach to individual sources. The intention is to develop a methodology for assessing the total flux of lead leaving a works from all sources and the contribution of individual sources to the total, which would be used to determine the most cost-effective control approach.

On electricity works, the report mentions to the closure during the year of the oil-fired Bankside power station and with it "the longest operating and most successful flue-gas desulphurising system in the world". Over 29 years of continuous operation, the overall efficiency of sulphur removal averaged 97.2%, although the system did suffer two environmental disadvantages: the adverse effect on river water quality, and occasional problems with plume dispersion. Flue gas washing was never a formal requirement of BPM but remained a consent condition only; however, recent remarks by Leslie Reed indicate that if ever any new fossil fuel power station is built, specific control of sulphur emissions might be required.

Dr. Reed announced that the Inspectorate's title, having outworn its usefulness, would shortly be changed to (HM) "Industrial Air Pollution Inspectorate".

The report also contains an account of the work of HM Industrial Pollution Inspectorate for Scotland. Again, mention is made of industrial recession and the rundown of production which had its effect on the work of the Inspectorate. "On the one hand plant has become more readily available for extensive overhaul and maintenance; on the other, capital has been less obtainable for the renewal of obsolescent equipment. It has been necessary at times to agree to the deferrment of some important replacements and improvements."

The report of the Chief Alkali Inspector, Department of the Environment, Northern Ireland for the year 1981 has also been received. Of interest is the reference to Belfast West Power Station (chain grate stoker firing) which was designed and commissioned before emissions to atmosphere from this type of works were controlled under the 1906 Alkali Act. The station was to be closed in 1981/82 and although standards of emissions were not up to scratch, in view of the impending closure the Chief Inspector had with reservations agreed not to impose more stringent standards. However, the station is now likely to carry on operations until the early 1990s, so a study group has been set up to look at chimney emissions and decide what further controls will be necessary.

In Northern Ireland, as in the rest of the UK, recession has hit the minerals industry particularly hard and there was, says the report, little capital available for environmental improvement. Northern Ireland's Inspectorate also deals with radioactivity and mention is made of one "abnormal incident", involving the theft of strontium 90 source from a boy's secondary school in Londonderry: "The public were alerted by way of the media to the potential danger and the source was returned intact to the school next day."

1. *"Industrial Air Pollution. Health and Safety 1981". London, HMSO, Oct. 1982. £4.00 net.*
2. *Report of the Chief Alkali Inspector for the year 1981". Dept. of the Environment, Northern Ireland. Belfast, HMSO, 1982. £2.30 net.*

ENVIRONMENTAL HEALTH REPORT 1981

Institution of Environmental Health Officers

The Institution has performed its usual excellent job of compiling a report on all aspects of environmental health work, based on information provided by 341 district councils of England and Wales and the Northern Ireland local authorities. Discussing environmental policies in the present period of economic recession, the report recommends a wide scale and planned programme of energy conservation which will conserve scarce natural resources and consequently help in the reduction of air pollution.

Referring to the 1979 report comment on the difficulty of justifying the establishment of new smoke control areas unless air quality required such action, the 1981 report identifies two factors which require a reassessment of that statement. The first is that smoke control offers possibilities for overall fuel cost savings, which are estimated at £45,000 per year (assuming the conversion of one room in each of 1,500 dwellings to either solid fuel or gas). The second factor is the future expansion of industrial use of coal which might bring about overall increases in smoke and sulphur dioxide concentrations.

The Institution indicates that greater enforcement might be needed to control "a deteriorating situation" in relation to contraventions of the Clean Air Act provisions on industrial smoke emissions, grit and dust. These run well into four figures, and the trend is continuing. On new furnaces, the report notes with concern the low level of notifications; the requirement is that all new boiler plants above 55,000 Btu's per hour (which include some domestic central heating boilers) should be notified to the appropriate local authority by the installer. It is inconceivable, says the report, that the 1981 level of 1019 notifications could represent the total number of installations of boilers in this category.

Referring to consultation on local industrial air pollution problems, the report mentions the success of INDEMAT-type and local liaison committees, concluding (as did an earlier NSCA seminar) that there is no real evidence of great interest amongst the general public in information on emissions except where they personally experience the effects of air pollution from specific industries.

One of the most interesting points in the pollution control section of the report is the call for more specific guidance to be given on the risk to health of a variety of pollutants. "It would be of value to have more definite guidelines established, against which local authorities could make sensible evaluations of pollution levels." Where there is considerable public concern over lead, for example, evaluation of monitoring results is meaningless until more definite risk levels for the pollutant have been determined. In the meantime the report calls for adequate monitoring in order to establish pollution levels and at the press conference Mick Archer made it clear that 'adequate monitoring' for lead entailed prior formulation of standardised monitoring and analysis methods, together with some national co-ordination of the monitoring effort.

Among other specific recommendations made in the report are that the proposed regulations on grit or dust emission should be introduced as soon as possible; that further consultation should take place between the Institution and HSE on the consultative document on registered works and scheduled processes; and that there should be a review of powers contained in Part IV of the Control of Pollution Act.

INDUSTRIAL NEWS

THE ROTATING DISC GAS SCRUBBER – A NEW CONCEPT IN AIR POLLUTION CONTROL

by

David Romaine
Individual Member, NSCA

1. Introduction

As the industrialised world becomes increasingly aware of the effects of air pollution, new and ever more stringent standards of control are imposed upon industry. Processes which in the past have been considered innocuous are revealed in their true colours of health hazard or nuisance and local and central government agencies demand the installation of sophisticated gas cleaning plant.

When faced with such demands industry requires plant which will meet present, and hopefully, future emission control standards, is economical to operate, easy to install and does not involve enormous capital cost. Traditional methods of gas cleaning do not unfortunately meet all these requirements. Low cost methods of gas cleaning are available but have low efficiency, and high efficiency methods such as bag filters, high energy scrubbers and electrostatic precipitators are bulky and expensive.

Recognising the disadvantage of traditional gas cleaning equipment Alfreton Engineering have produced the "Klensair" range of revolutionary new gas scrubbers. This equipment can provide industry with a gas cleaning system which is highly efficient, economical to operate and purchase, easy to install and which can handle a wide range of airborne pollutants.

2. Gas Scrubbing Plant. Principles of Operation

Gas scrubbers and wet washers are devices using mixed phases of liquid and gas in which the suspended particulate matter in the gas is transferred to the scrubbing liquid. The cleaned gas can then be utilised or discharged to atmosphere whilst the dirt laden liquid is removed from the device, cleaned and usually recirculated.

Traditionally wet washers and scrubbers have been employed in applications where the dirty gas was either at high temperature or contained substances such as acid fume which could best be collected in a diluted form. The system of collection has, however, certain advantages compared with other methods of dust collection and the Klensair unit uses these advantages to the full.

The action of a gas scrubber depends on the collision between dust particles and liquid droplets in suspension in the gas. The liquid/gas interaction can be achieved by three basic methods distinguished by the form of the liquid. These are described below:—

(i) *Liquid Droplets*

If liquid droplets are injected into a gas stream or generated within the gas stream, they will deflect the gas flow. This flow change will create inertial forces on the dust particle and can cause its displacement into the liquid droplet. Electrostatic and molecular diffusion forces may also act on the dust particle and encourage its displacement into the liquid droplet. The liquid droplets can be produced in the collection space by means of nozzles, flow forces or rotating elements. The removal plane in this type of collector is the liquid surface.

(ii) *Liquid Network*

In a liquid network, gas and liquid paths intermingle as, for instance, in a sprayed packing.

The flow through such a system also produces deflections in gas flow leading to collection primarily by inertial effects.

(iii) *Liquid Layer*

In this type of system, the gas is passed through the liquid which remains in a coherent form. The fume can therefore only pass through in the form of bubbles or channels. In this system, as in the other scrubber systems, collection is primarily due to inertial effects. Collision and thereby coalescence of the liquid and dust particles is due to one or more of the following effects:

2.1 *The Wetability of the Dust Particles*

When a liquid is in contact with a solid substance, a force which governs capillary action will arise between the molecules of the materials in contact. This force can be expressed in terms of the wetting angle and it can be shown that transfer of dust particles into the liquid is favoured by the boundary layer forces at wetting angles less than 90°, the boundary layer forces will oppose the transfer of the dust into the liquid when the wetting angle exceeds 90°.

2.2 *Inertial and Gravitational Forces*

The probability of collision between droplets of scrubbing liquid and suspended particles in the gas increases with the relative velocities of the droplets and the particles. The dust collection potential of a droplet increases with the flow velocity and the particle size and with a decrease in the droplet size.

2.3 *Electrostatic Effects*

Many dust particles carry an electrostatic charge and since the dust particle is usually at earth potential, there will be an attraction between the liquid droplet and the particles.

2.4 *Diffusion Effects*

Very small particles are in random (Brownian) motion which increases their probability of collision with liquid droplets which are not subject to such motion.

2.5 *Thermodynamic Effects*

If hot gas is cooled below saturation temperature, the dust particles behave as condensation nuclei on which condensing vapours selectively deposit, thus increasing the mass.

These effects will not influence all particles in the same way and in a wet washer the dominant collection mechanism is due to inertial forces. Thus, to achieve the best efficiency, a gas washer must be designed to ensure that contact between gas and liquid is arranged in a way which will capitalise upon this effect.

Inertial forces give good dust collection under the following conditions:—

a) high flow or relative velocity of liquid and gas
b) liquid surfaces of large curvature or small radius of curvature
c) frequent deflections, i.e. large number of droplets

These criteria formed the basis of the design of the Klensair system. The design requirements for mechanical reliability and maximum utilisation are discussed in section 3.

3. Additional Design Criteria for Efficient Gas Cleaning Plant

In order that a gas scrubber can achieve its maximum potential, certain mechanical requirements must be met. Listed below are those considered to be most important, and which were incorporated in the design of the Klensair units.

3.1 *Ability to use recirculated water*

The efficiency of a gas cleaner of the liquid droplet type is largely dependent upon the presence of a large number of small droplets in the collection zone. If atomising sprays are used to break water down into suitable droplet sizes, the pressure drop at the spray increases with the fineness of the droplet produced. To achieve a fine spray in this manner can therefore be expensive in terms of energy, and furthermore, contaminants in the water may cause wear at the spray nozzles and a consequent reduction in spray quality. Thus a desirable feature of any gas scrubber is its ability to use recirculated water which has not been extensively and expensively cleansed. In the Klensair system, the spray is produced by rotating discs and is therefore unaffected by water quality and the supply pressure.

3.2 *Ability to Handle Variable Gas Flows and Particle Loadings*

In many applications a dust collector will be required to handle gas flows and particle loadings which are of a variable nature. It is therefore an advantage if the collection efficiency of the scrubber is independent of these parameters. In a gas scrubber, collection efficiency is largely a function of the total energy input. Therefore, it is an advantage if a large proportion of the energy input is applied to the water and not to the gas flow. In the Klensair unit, the gas/water power ratio is of the order of 1:1.

3.3 *Removal of Water Droplets from the Exhaust Gas*

Any water droplets exhausted from the scrubber will, if the device is working efficiently, contain solid material. This material could cause serious localised pollution problems and it is therefore most important that the scrubber be fitted with an effective mist eliminator. The Klensair system employs a mist eliminator composed of a rotating disc and the main fan. Effective mist removal is therefore achieved without the pressure drop which can be associated with conventional mist elimination sections.

3.4 *Protection Against Erosion*

In high energy scrubbers solid particles in either the water or the gas can cause a high rate of erosion of the scrubber and drastically reduce the life of the unit. However, if an adequate supply of water is present it not only provides a collecting medium for the gas but also acts as a lubricant and reduces erosion. Consideration must therefore be given to the way in which the water is introduced and to the design of the internal surfaces of the collector.

3.5 *Noise*

Conventional gas cleaning plant is all too often the source of high levels of noise. Some of this noise is generated by rotating machinery such as fans, pumps and motors and most of the remainder is aerodynamic noise caused by the movement of the gas within the collector. The noise levels produced by such equipment will usually preclude its installation within the workspace and if it is installed outside, may lead to complaints from local residents.

The Klensair units were designed in such a way that noise emission is kept to a minimum and the units can therefore be installed within the workspace and the cleaned air directly recirculated, thus avoiding heat loss from the building.

4. **The Principle and Advantages of the Klensair Gas Scrubber System**

The basic Klensair unit (Figs 1 and 2) consists of a vertical cylinder, composed of three flanged sections, housing a hollow vertical shaft on which are fitted three solid discs. A fan is mounted on the top of the shaft which is driven by belts from an electric motor installed at the side of the unit.

When the unit is in operation, the fan, shaft and discs rotate and contaminated air is drawn upwards from the base of the cylinder. Water from the tank at the base of the unit is pumped up the hollow shaft to the underside of the two lower discs where, due to centrifugal force, it forms a high energy water barrier between the disc periphery and the cylinder wall. In its passage through the unit, the contaminated gas is turned through several right angles and drawn through the two water barriers. Particulate matter suspended in the gas stream collides with the water droplets and is carried to the cylinder wall and thence to the tank at the base of the unit. The cleansed air passes through the mist eliminator section, consisting of the third disc and the fan, and is exhausted to atmosphere whilst the dirt laden water is passed through a simple filter system and recirculated. The particulate matter collected in the tank can be removed automatically or by means of manual dredge.

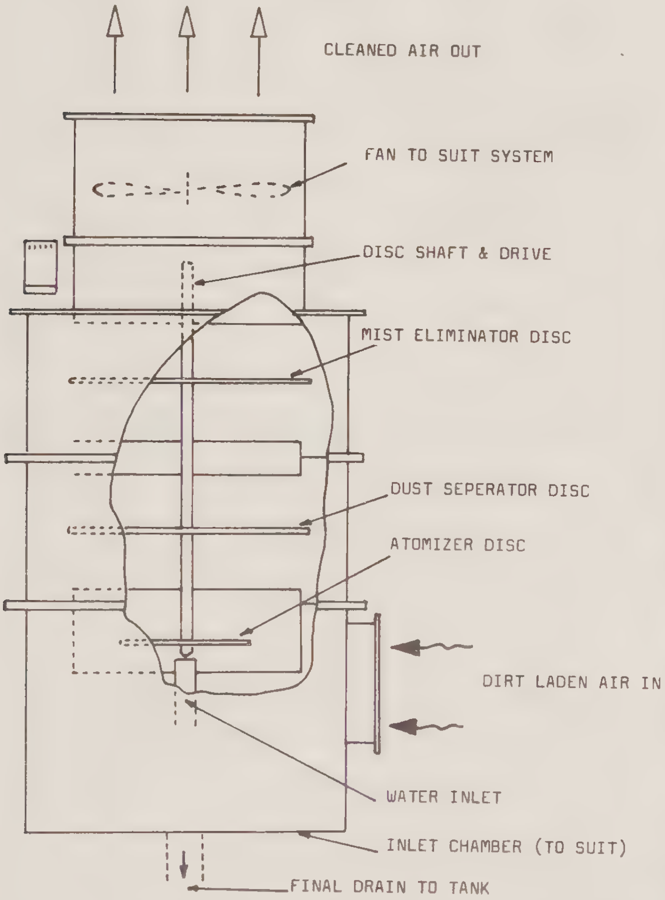


Fig. 1 **Klensair System – General Layout only (access doors/details omitted for clarity)**

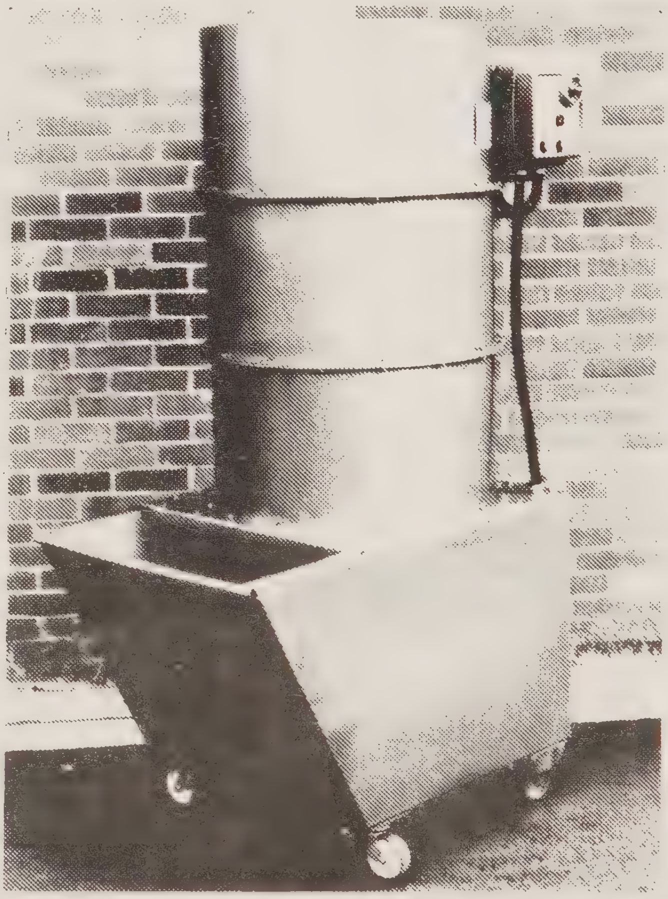


Fig. 2 **Basic Klensair Systems (1000 CFM)**

The manufacturers consider that the Klensair system represents a major advance in gas scrubber design.

By using a rotating disc to generate a high speed water spray, the erosion and blockage problems associated with high pressure sprays are eliminated and optimum droplet size can be maintained irrespective of water quality. Furthermore, the integrity of the water barrier is solely a function of the rate of rotation of the disc and is independent of gas velocity. Hence the unit is suitable for variable gas flows and particle loading.

Carryover of particulate matter and contaminated water is prevented by the highly efficient mist eliminator section of which the fan forms an active element.

Klensair units are being used by a number of industries to handle a wide range of airborne pollutants and there have, to date, been no reports of erosion problems. However, units intended for use in particularly arduous conditions could easily be equipped with replaceable attrition liners. Finally, the principle of the Klensair system is such that the unit is constantly cleansing itself, thereby saving costly manpower required for this otherwise regular task.

5. Noise Levels

The standard Klensair units are intended to be installed within the workspace; this is usually more convenient and avoids heat loss from the working area which occurs if cleaned air is discharged directly to atmosphere. It is, therefore, important that noise is kept to a minimum. Table 1 and Fig. 3 show the levels of noise produced by a standard Klensair unit, in this instance the TSB 1,000. The measurements were made inside the factory building, at a distance of 3m from the unit in the four positions shown in Fig. 4. From the data given in Table 1 and spectral comparison shown in Fig. 3, it may be seen that overall noise levels are in the range 67-69 dB(A) and noise spectra are essentially broad band in nature. This means that the noise is neither intrusive nor of a level which would interfere with normal speech communication.

6. Performance

One of the most attractive features of the Klensair system is its wide field of application. To date, units are working on air cleaning tasks in the leather industry, footwear manufacture, plastics, general engineering and agriculture, and users are delighted with the performance and reliability.

Each field of employment involves a different pollutant with different characteristics, but initial tests indicate that under normal operating conditions, a standard unit can achieve efficiencies which match or exceed those of conventional systems.

A particularly demanding application which is currently being investigated involves the removal of carbon black particles from air discharged from a die casting shop. Carbon black is not an easy material to collect, but preliminary trials indicate that collection efficiencies of 85% can be achieved by the standard machine and a modified unit with three wet discs will be even more efficient. It seems likely that in this instance it will be possible to achieve high standards of collection for a capital expenditure of 1/5 — 1/10th that of a conventional collector.

7. Fields of Application

Klensair units are already being used in the leather industry, footwear manufacture, plastics, general engineering and agriculture. It is foreseen that applications also exist in the industries listed below:

Woodworking; Mineral treatment; Rubber Manufacture; Brick and stone working; Ceramics; Paint; Soap; Metal finishing; Grain Milling; Chemical Industries.

The standard unit can also be adapted for a specialised role and it is envisaged that units will be built to handle acid fume and for the aeration of liquid effluents.

OCTAVE CENTRE FREQUENCY Hz	SOUND PRESSURE LEVEL (dB) BACKGROUND	POSITION 1	POSITION 2	POSITION 3	POSITION 4
31.5	48	62	59	60	60
63	56	68	64	70	65
125	47	66	65	62	60
250	43	63	62	63	62
500	46	66	67	66	64
1k	34	65	65	64	63
2k	30	62	62	61	60
4k	25	60	58	60	57
8k	-	45	44	45	43
OVERALL LEVEL dB(A)	49	69	69	69	67

Table 1 Klensair T.S.B. 1000 Sound Pressure Levels at Positions 1-4 (see Fig. 3)

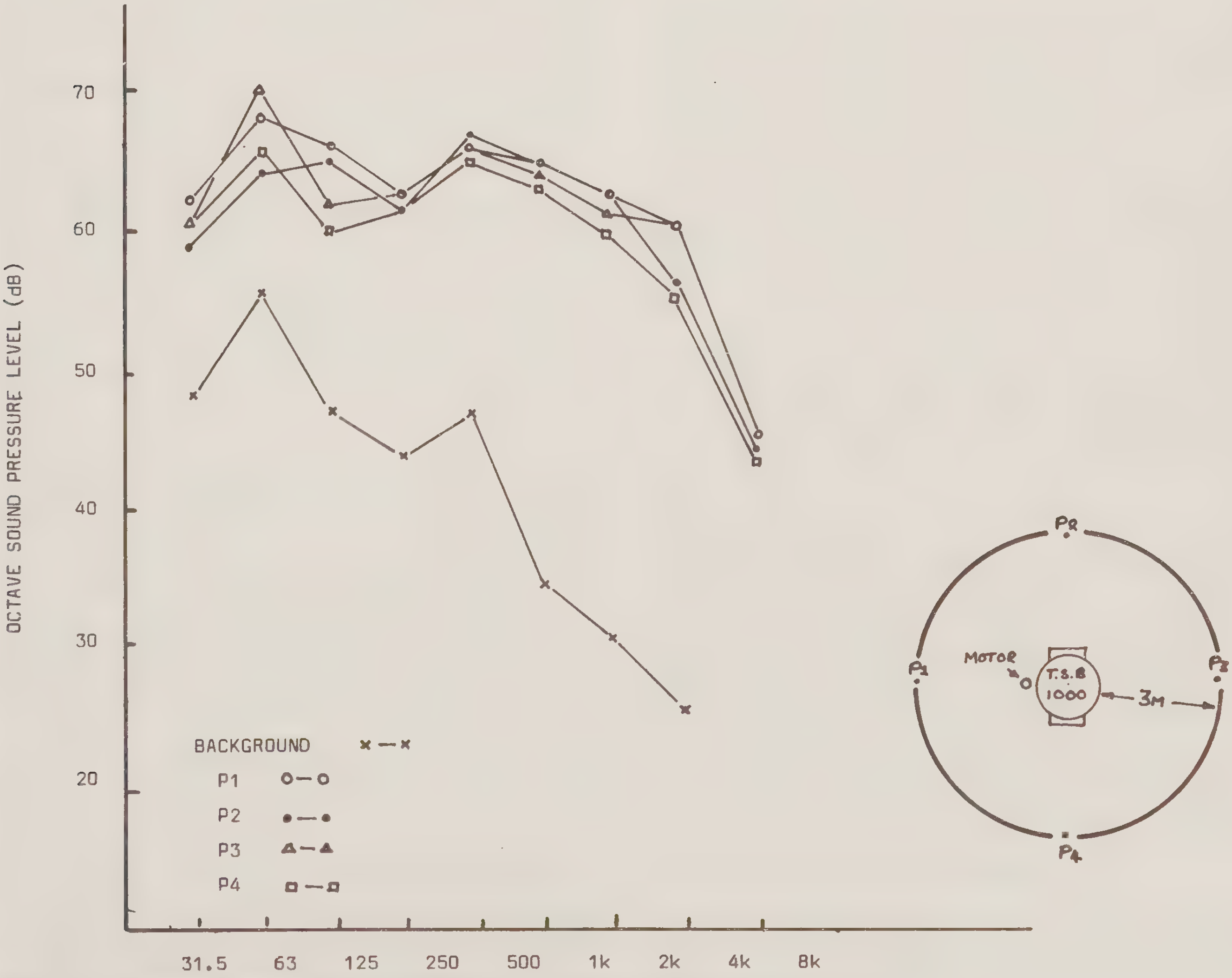


Fig. 3 Noise Levels T.S.B. 1000

The New Industrial Noise Standard

With the publication of the new British Standard 5969 (IEC 651), the accuracy of an industrial sound level meter has been up-graded from the previous BS 3489.

To meet this new requirement Pulsar Instruments have introduced the Model 85E2. Intended for use in Europe and the Pacific basin, the 85E2 features not only BS 5969 Grade 2 accuracy, but a detachable, half-inch, electret microphone capsule on a pullout boom to further improve the acoustic response.

The scale of the 85E2 reads not only the sound level in the range 55 to 114 but also the amount of time a worker may be exposed to a particular level. This information can be read straight from the scale which is colour coded, orange and red, to further remind the user of dangerous levels.

Equipped only with dBA Slow response, the Model 85E2 is an ideal tool for industrial safety work being specifically designed, both electrically and ergonomically, for such use. Price: £160.

Reader Enquiry Service No. **8224**

MEB's Second 'Save-It' Power Station

The Midlands Electricity Board is to begin work on a £14½ m. Combined Heat and Power Station at Fort Dunlop, Birmingham, and some of the technology to be used is believed to be a world first.

The Dunlop CHP Station will be the second to be built by the MEB, the first being at Hereford (details in *Clean Air*, Vol. 12, No. 1). The bulk of the complex machinery and equipment in the new Station will be made in Britain. "We believe in British craftsmanship and our nation's engineering skills are second to none", says the MEB.

The Dunlop Station will produce 24 MW of electricity which will be fed into the Board's own 132,000-volt distribution network and the equivalent of 55 MW of heat in the form of steam (47 MW) and hot water (8 MW).

The method of producing heat in this Station will be what the MEB is confident is a world first — by combining two coal burning boilers with two 15,000 h.p. marine type diesel engines running on the lowest grade of residual oil. The Station will have a thermal efficiency of around 80% compared with around 35% of conventional power stations — which are built solely to produce electricity.

The engines' residual oil is the sludge left behind after the extraction of petrol and chemicals at the fuel refineries. Special equipment at the CHP Station will filter and thin the oil to enable it to be used in the engines.

As well as driving a generator to produce the electricity, each engine also provides two other energy-saving benefits: one is that the exhaust gas is used instead of air and is fed into the two coal fired boiler furnaces thus increasing the efficiency of the coal burn: the other is that boiler feed water will be pre-heated by heat from the engines' cooling systems and exhaust gases.

By making the maximum use of coal and residual oil in the production of electricity and heat, as well as pre-heating feed water for boilers elsewhere in the Dunlop complex, the MEB's combined heat and power station will save, in full operation, an estimated 42,000 tonnes of fuel a year — a saving of £1,750,000 at today's prices of fuel to conventional power stations.

The CHP station will provide two-thirds of Fort Dunlop's steam and hot water needs at a significantly lower cost compared with existing boiler plant, thereby making an important contribution to Dunlop's competitiveness in the tyre market.

As at Hereford, environmental protection has been a major consideration in the Station's design. The latest technology will be used to deaden all engine noise and minimise exhaust fumes from boiler furnaces. All fuel will be delivered to the Station by rail, with the whole site being shielded by a screen of trees.

The MEB held a series of meetings with local residents associations, local Councillors and Planning officials to discuss the whole project before applying for planning consent.

Reader Enquiry Service No. **8225**

Traffic Compatible Battery Electric Road Vehicles

The increasingly vital need to husband the world's finite fossil fuel resources was a major factor in the decision by Southern Electricity to develop an integrated unit of traffic compatible battery electric vehicles into their 3,000 strong commercial fleet.

Southern Electricity took delivery of their first electric vehicles in January, 1979 and now, after proving trials and commissioning, have three years of operational experience. Their fleet comprises 22 Dodge/Chloride Silent Karrier IA based on the Dodge/Commer KC60 Chassis more commonly known as the "Walk-thru", eight Lucas/Bedford CFE vans and 20 of the Dodge 50 series — the first traffic compatible electric road vehicles to be manufactured on an automotive assembly line.

The Silent Karrier, with a normal working range of 50 miles, has a top speed of 40 mph on the level compared with 48 mph for a similar diesel vehicle, and acceleration from 1 to 30 mph is 19 seconds compared with 23 seconds for a comparable diesel vehicle. Energy consumption is running at an average of 1.6 kWh per mile which compares with 20 miles to the gallon (diesel).

The Silent Karriers perform a variety of duties on the same basis as their equivalent internal combustion engined vehicles for which they can be directly substituted. One of their many uses is appliance delivery for which the vehicles are fitted with demountable bodies and integral tail lifts.

Mobile workshop bodies for cable jointing and substation fitting teams, and bodies to carry special plant for substation painting, have also been fitted to these chassis. A task for which electric vehicles have proved particularly suitable is street lighting maintenance, and for this purpose a number of chassis have been fitted with 21 foot electro-hydraulic platform towers. Their low centre of gravity also makes them very safe and eliminates the need for the jacks and stabilisers required on conventional vehicles fitted with these towers, making them quick and easy to use.

Although the Bedford/Lucas CFE vans are available in several versions Southern

Electricity specified the simple rear-loading version. This was the nearest specification to the 350 internal combustion engined vans currently being used by service electricians. The payload and crew allowable weight is 1 tonne and the planned working range is 60 miles between charges. Top speed is 50 mph compared with 62 mph for the equivalent diesel vehicles, but also in this case acceleration from 0 to 30 mph is quicker with the battery electric than the diesel.

The latest generation of electric vehicles in Southern Electricity's fleet — the Dodge 50 series of which the Board have 20 — are now playing their part in the commercial life of the Board. With its 50 mile radius working range on fully charged batteries and 40 mph top speed, this vehicle with its body/payload of about 2.35 tonnes is suitable for many types of body work to be fitted on its normal chassis cab. Southern Electricity are using these vehicles for appliance deliveries or as mobile workshops in their Portsmouth/Chichester, Isle of Wight, Ealing, Staines, Slough, Lyndhurst/Southampton, Bournemouth/Salisbury and Reading Districts.

Said Southern Electricity's Transport Officer, George Steele "We are confident in saying that the battery powered Dodge 50's are just as efficient as the internal combustion engined counterparts and provide the high results expected of our vehicles."

The "electric" Dodge 50 offers an eight year life span against the expected five year life of its diesel equivalent. Taking this into account, the whole life running costs of these vehicles compare very favourably with their diesel counterparts. Basically, the cost of batteries plus energy consumed is about equal to fuel costs of an equivalent petrol diesel engined vehicle.

Comparable on a cost and operational basis, the battery powered Dodge 50 offers the advantage of lack of noise and fumes together with considerable driver comfort. As Southern Electricity's Chairman, John Wedgwood, said "We are convinced that the place for lead is in the battery not in the air."

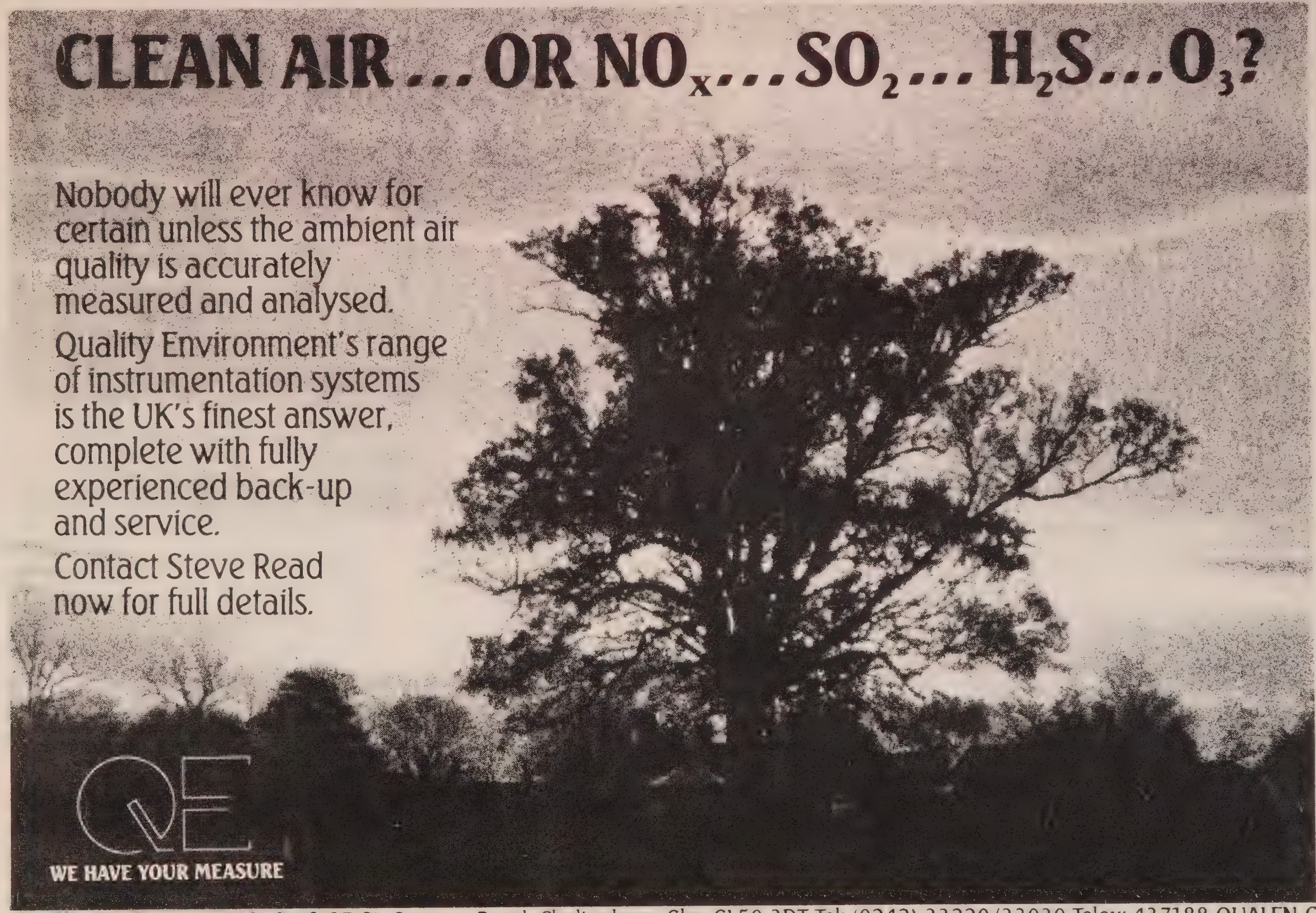
Most leading economists forecast that oil prices will rise far higher and far faster than electricity prices and with fuel accounting for twenty per cent of the cost of a diesel vehicle, Southern Electricity feel strongly that the time for electric vehicles in every transport fleet is now.

Reader Enquiry Service No. **8226**

Caring for the environment

The Central Electricity Generating Board has received some 55 Commendations and Awards for environmental schemes at power stations, substations and associated nature trails and field study centres in England and Wales.

Reader Enquiry Service No. **8221**



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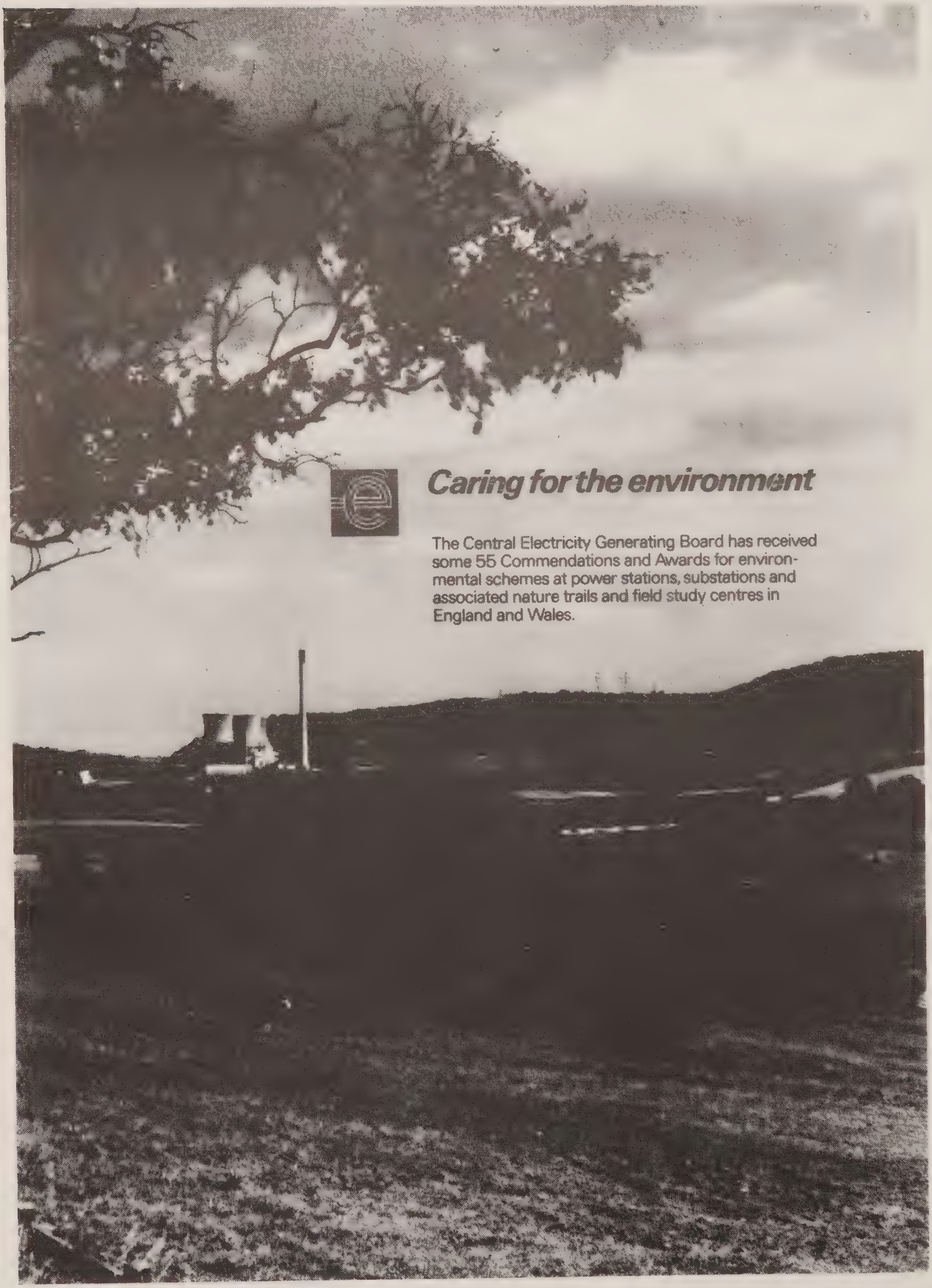

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

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Contents **Page**

Estimating Heavy Metal Emissions from Iron Foundry Cupola Furnaces
S.A. Simmons 127
NSCA Membership Subscriptions 1983 138
European Move for Lead-Free Petrol 139
"Polluter Pays" Principle – NSCA Views 140
Divisional News 142
Keeping Up the Facade – buildings' repair and cleaning 144
Smoke and Sulphur Dioxide Emissions and Concentrations in Ireland
M.L. Bailey 145
Emissions Trading: Save Our Air – Save Our Money
G.L. Brady 151
Atmospheric Pollution in Car Parks 154
Industrial News 155

Index to Advertisers

Central Electricity Generating Board cvr. ii
Coalite Group plc cvr. iii
Quality Environment Limited cvr. iv

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LOOKING AHEAD

This fourth issue of 1982 has been rushed out hot on the heels of the third — which should have been published some six weeks earlier than it was. Our profuse apologies for the delay, which was due to an editorial and printing bulge around Conference time. We are planning to avoid the problem next year by publishing *Clean Air* at the beginning of March, June, September and December. Latest dates for copy to Editor will therefore be January 15, April 8, July 8 and October 7, 1983. The first issue of 1983 will contain a detailed report on the Llandudno Clean Air Conference, which was very successful both in content and attendance.

Those who enjoyed the Annual Conference and have been to previous NSCA Technical Workshops will probably have studied with interest the programme for the March 1983 event in Sheffield on **Coal and the Community.** At Llandudno, attention was drawn to the implications of greater exploitation and use of coal and the Workshop programme has been designed to stimulate the widest possible discussion of the environmental problems and their solution. The workshop format allows for considerable input to debates by delegates, and the subjects will be relevant to planning authorities, control agencies — especially local authorities' pollution control officers — and industrial users and carriers.

We look forward to seeing you at Sheffield. Meanwhile, we wish all our readers a very happy Christmas and a prosperous, trouble-free New Year.

ESTIMATING HEAVY METAL EMISSIONS FROM IRON FOUNDRY CUPOLA FURNACES

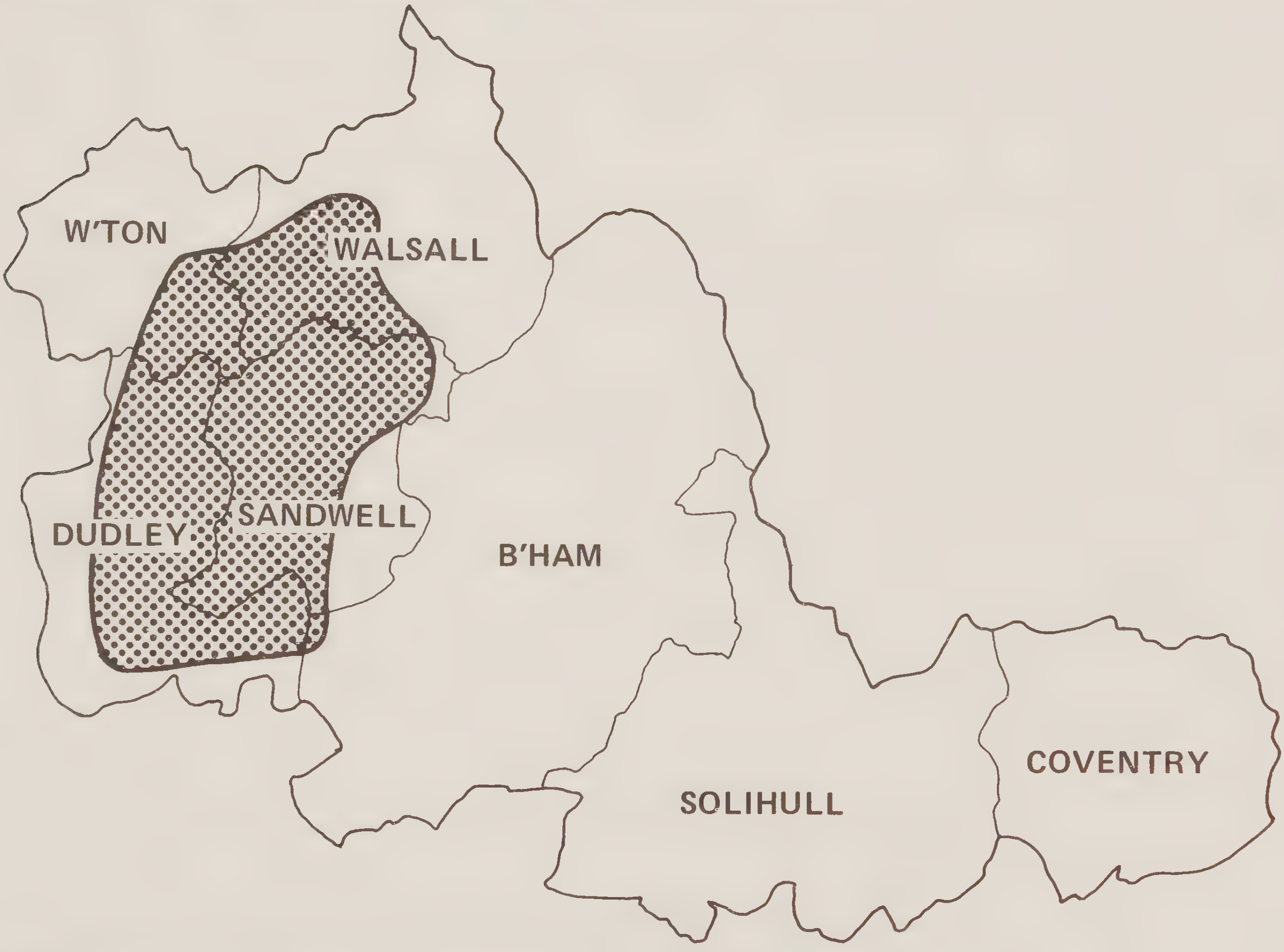
by

S.A. Simmons

JURUE, University of Aston in Birmingham

The ironfounding industry of the West Midlands has long been linked with air pollution problems. The confinement of a large number of cupola furnaces within a small geographical area known as the 'Black Country' (Figure 1) acts to multiply the effects that their emissions have on air quality. This paper examines one aspect of the air pollution problems associated with cupolas, namely the heavy metals present in grit, dust and fume emissions. A simple heavy metal emission inventory has been compiled for the West Midlands, based on a grossing-up technique using data acquired from local authorities and from investigation of some case-study foundries.

Figure 1. The West Midlands and the Black Country (shaded).



The Problem of Estimating Emissions by Conventional Means

The most obvious way of determining the total quantity of heavy metals emitted from cupolas in the West Midlands would be to take actual stack samples from every cupola in the area. Unfortunately this would require resources far beyond those available to most organisations. There are also technical difficulties in the stack sampling approach. The BCURA stack sampling probe is the most widely used apparatus for sampling stack emissions,(1) but for many existing cupolas this instrument could not be used for the simple reason that the height of stack above the arrestment facilities is either too short to allow sampling, or there are no facilities for taking samples (normally a 4 in. BSP socket with clear internal diameter of 108 mm (2)).

Sampling a limited cross-section of those cupolas that do have access holes would seem to be one way around these technical difficulties but two further problems would be encountered when the information obtained was grossed up:—

i) *Representativeness over Time:* heavy metal emissions can vary considerably both during one melt cycle and between separate melt cycles, reducing the representativeness of a reading taken only during the middle period of a melt cycle, i.e. after start-up and before blow-down (3).

ii) *Representativeness between types:* the cupolas in the West Midlands vary widely in size, operation, charge make-up and pollution abatement facilities. Obtaining samples from some of the small but common cupola types would be difficult.

Because of these difficulties a different method of determining the quality and quantity of cupola emissions has been devised.

Heavy Metal Emission Estimation:— Summary of Method

The method that is described in this paper falls into two parts, the first dealing with the metals emitted as *contaminants of grit and dust,* and the second with metals emitted as an *integral part of metallurgical fume.*

Taking first the method for grit and dust, the procedure may be summarised as follows:—

(a) Information was collected on the numbers of cupola furnaces in the West Midlands, expressed as the number of cupolas in each Borough within three size ranges based on melt rate:

* below 3 tons
* 3 — 10 tons
* over 10 tons

(b) A typical mass emission rate for each cupola size range was calculated. This was expressed as an annual mass emission of grit and dust per cupola furnace, based on a number of assumptions:

* cupola grit and dust emissions are on average equal to the limits given (in terms of lb/hr) to the Second Working Party on Grit and Dust(4) and the Draft Regulations on Emission of Grit and Dust from Furnaces(5)

* cupolas are working for half of an average 35 hour working week for 50 weeks per year.

(c) The typical heavy metal content of the grit and dust emitted was estimated from laboratory analysis of samples of grit and dust collected in the arrestment systems operating on a cross-section of furnace types. Four types of furnace were investigated in detail in this way, these furnaces being selected to cover the range found within the West Midlands.

(d) Total emission of heavy metals in grit and dust is as calculated by multiplying the total estimated mass emission of grit and dust [from (a) and (b)] by the typical metal content [from (c)] .

The procedure for calculating fume emissions is more qualitative in nature because of the lack of comparable data on mass emissions.

(e) Total mass emissions of fume were assumed to be on a 1:1 ratio with the mass emissions of grit and dust (this is an approximation based on published data).

(f) The heavy metal content of fume was estimated from the laboratory analysis of samples of the finest fraction (below 75*u*) of the material collected by a full fume arrestment system attached to one of the four cupolas examined in detail.

(g) Total emission of heavy metals in fume were calculated from (e) and (f) by the 'grossing-up' procedure described in (d).

The rest of this article describes the procedure and results in detail.

The Cupola 'Inventory' [stage (a)]

Information regarding the existing cupolas within the West Midlands was given to us by Local Authorities. This is summarised in Table 1. From the information it was clear that

	Ironfoundries Total	Cupola units	Closures over last 12 months (80-81)	Melting Rate 'tons/hour' for Cupolas		
				3	3-10	10
Birmingham	2	2	2	—	—	2
Coventry	2	4	3	—	—	4
Dudley	21	39	2	3	32	4
Sandwell	33	38	7	10	7	21
Walsall	22	34	5	6	24	4
Wolverh'ton	7	14	—	4	4	6
	87	131	19	23	67	41

Table 1: Cold Blast Cupolas operating in the West Midlands (from data supplied by Local Authorities (1982).)

four basic types of iron foundry cupola were found in the region; three of these were fairly common, while the fourth was a foundry with hot-blast cupolas which was the only example of its type, the rest being cold-blast cupolas. The four types are described below, followed by a brief description of the particular foundry chosen as a 'case-study' example for analysis of arrested grit and dust.

Type A: Small, low capital plant with low quality products, e.g. manhole covers. Pollution control approached as a low priority. The study example is a foundry producing grey iron manhole covers using twin 4 ton per hour conventional cupolas (actually running at 3 tons per hour) and two simple wet arrestors. Charge make-up consists of low quality metal and scrap.

Type B: Medium investment and capacity with medium grade products e.g. gearbox castings. The study foundry of this type is a modern plant with twin 7 ton per hour conventional cupolas. Emission control is provided by F.T.L. Cool Cap Dry Emission Control System.

Type C: Medium size, high technology plant with high quality products e.g. cylinder blocks. The chosen example of this type of foundry is a highly efficient plant of twin 12 ton per hour cupolas and electric induction holding furnaces, producing malleable and grey iron castings. Pollution control is by means of a single high efficiency double water curtain wet arrestor.

Type D: High production and technology with high quality products (e.g. cylinder heads). The example chosen to illustrate this class is a hot blast cupola installation rated as twin 30 ton per hour cupolas with 2% oxygen enrichment. Blast heating is provided by a recuperator system and gas cleaning by a high energy rotary scrubber.

This classification formed the basis for the sampling and analysis of arrested material, described later.

Total Mass Emission of Grit and Dust [Stage (b)]

The mass emission coefficients were based on the recommendations of the Second Working Party on Grit and Dust(4) and part II of the Draft Regulations on Emission of Grit and Dust from Furnaces(5) where limits in terms of mass of grit and dust per hour for cupolas in terms of melt rate are given. Table 2 shows the maximum allowable discharge in lb/hr for different furnace sizes, and Table 3 shows the range of annual emissions for different furnaces at different rates of annual usage (hrs/year). With the usage assumptions already mentioned and converting to metric units, we obtained the following estimated emission coefficients for the three cupola size ranges:

* below 3 tons : 11,200 kg/year/cupola
* 3 – 10 tons : 10,500 kg/year/cupola
* over 10 tons : 11,700 kg/year/cupola

Table 2. Maximum Allowable Discharges of Grit and Dust (4)

Size (tons/hr)	Allowable Discharge (lb/hr)
Less than 2	13.2
2 – 3	19.8
3 – 4	15.7
4 – 7	18.5
7 – 10	20.6
10 – 15	22.8
15 – 20	24.8
20 – 30	28.8
30+	30

Table 3. Annual Allowable Stack Emissions from Cold Blast Cupolas

Based on recommendations of the Second Working Party on Grit and Dust 1974(4), for all new cupolas emissions lbs/yr

Size of Cupola tons/hour	Annual Usage (hours/year) Less than 250	250 to 500	500 to 1000	1000 to 1500	1500 to 2000	2000 to 3000	3000 to 4000	4000 to Over
less than 2	3,300	4,950	9,900	16,500	23,100	33,000	46,200	59,400
2 – 3	4,950	7,425	14,850	24,750	34,650	49,500	69,300	89,100
3 – 4	3,925	5,887	11,775	19,625	27,475	39,250	54,950	70,650
4 – 7	4,625	6,937	13,875	23,125	32,375	46,250	64,750	83,250
7 – 10	5,150	7,725	15,450	25,750	36,050	51,500	72,100	92,700
10 – 15	5,700	8,550	17,100	28,500	39,900	57,000	79,800	102,600
15 – 20	6,200	9,300	18,600	31,000	43,400	62,000	86,800	111,600
20 – 30	7,200	10,800	21,600	36,000	50,400	72,000	100,800	129,600
30+	7,500	11,250	22,500	37,500	52,500	75,000	105,000	135,000

Sampling and Analysis of Arrested Grit and Dust [Stage (c)]

Each study foundry was visited and a sample obtained that was composed of sub-samples taken from 1 week's collected grit and dust. This was analysed to determine the composition of six metals, Cadmium, Chromium, Copper, Lead, Nickel and Zinc. Each sample was also sieved to give samples of size ranges which were also analysed. The results of the sieve size analysis are shown in Table 4. The individual levels for lead and zinc are chosen here as examples, and the results are given in Tables 5 and 6 respectively. The total metal

Table 4: SIEVE ANALYSIS – PERCENTAGE DISTRIBUTION

Sieve Size* Microns (*u*m)	Simple Wet Arrestor 2x4t/h	Cool Cap Dry Collector 2x5 t/h		High Efficiency Wet Arrestor 12x12t/h	High Energy Rotary Scrubber (Hot Blast) 2x30t/h
		Inertial Collector	Multi-cyclone		
>3350	0.61	1.34	0.04	0.30	–
3350-2000	1.04	2.47	0.26	0.65	0.19
2000-500	39.35	34.97	35.39	28.51	16.40
500-150	42.38	54.22	63.75	61.85	54.85
150-75	10.57	5.82	0.37	6.76	16.05
<75	6.23	1.18	0.01	1.77	12.51

Table 5: LEAD Levels in Cupola Dust size fractions Metal level (*u*g/g) (ppm)

Size (*u*m)	Simple Wet Arrestor 4 t/h	Cool Cap Dry Collector 2x5 t/h		High efficiency wet Arrestor 2x12 t/h	High Energy Rotary Scrubber 2x30 t/h
		Inertial Collector	Multi-Cyclone		
>3350	14,411	1,055	1,393	120	–
3350-2000	8,584	4,484	1,939	234	5,109
2000-500	3,952	3,493	1,719	129	7,919
500-150	1,475	6,588	1,983	131	9,250
150-75	2,841	8,354	18,644	224	16,699
<75	9,604	23,442	28,047	700	21,746

Table 6: ZINC Levels in Cupola Dust size fractions Metal level (*u*g/g) (ppm)

Size (*u*m)	Simple Wet Arrestor 4 t/h	Cool Cap Dry Collector 2x5 t/h		High Efficiency wet Arrestor 2x12 t/h	High Energy Rotary Scrubber 2x30 t/h
		Inertial Collector	Multi-Cyclone		
>3350	20,655	3,613	493	2,319	–
3350-2000	14,245	3,172	408	2,076	9,416
2000-500	9,885	5,014	1,958	1,841	17,408
500-150	7,046	8,330	3,788	1,786	19,095
150-75	9,167	9,397	21,927	3,577	31,503
<75	20,722	28,785	417,142	5,274	40,165

Table 7: TOTAL METAL Levels in Cupola Dust Size fractions Metal level (*u*g/g) (ppm)

Metal	Simple Wet Arrestor 4 t/h	Cool Cap Dry Collector 2x5 t/h		High Efficiency wet Arrestor 2x12 t/h	High Energy · Rotary Scrubber 2x30 t/h
		Inertial Collector	Multi-Cyclone		
Cadmium	24	10	4	1	21
Chromium	235	220	206	72	271
Copper	3,271	2,055	1,714	129	568
Lead	2,323	5,682	1,949	151	11,783
Nickel	130	157	120	40	81
Zinc	7,259	7,312	3,191	1,993	23,428

levels are shown in Table 7, which consists of a weighted average metal content of grit and dust from each foundry taking into account the different concentrations in different size fractions. Finally, a general figure for the average heavy metal content of grit and dust from all types of foundry was obtained by averaging the data in Table 7. These final averages were those used in the estimation procedure and are given below:

Cadmium	13 mg kg^{-1}
Chromium	200 mg kg^{-1}
Copper	1600 mg kg^{-1}
Lead	4500 mg kg^{-1}
Nickel	100 mg kg^{-1}
Zinc	8700 mg kg^{-1}

Total Heavy Metal Emission in Grit and Dust [Stage (d)]

Total tonnages of grit and dust emitted from cupolas in each Borough were estimated by multiplying the inventory data by the emission coefficients, giving results shown in Table 8. A total of 1,408 tonnes are estimated to be discharged annually, the highest proportion being in Sandwell. What this means in terms of individual metals can be calculated quite simply by applying the typical metal concentrations given in the section above – these results are also given in Table 8, showing for example that a total of 6.3 tonnes of lead and 12.3 tonnes of zinc are emitted in this form.

Calculation of Metal Emitted in Fume [Stages (e), (f) and (g)]

Fume, as explained earlier, cannot be assessed by the same method as grit and dust because in most cases it escapes arrestment. The mass emission of fume is taken on a mass to mass basis with grit and dust emissions, i.e. one tonne of grit and dust gives an additional 1 tonne of fume. This is a crude assumption but due to the variations in mass of fume emissions both within and between foundries, it is felt to be sufficient for the purposes of this study, i.e. to give an indication of the magnitude of the problem. The total mass of fume emissions is therefore estimated to be the same as the data shown in Col. 1 of Table 8.

	Total grit & dust emission (tonnes year^{-1})	Cadmium	Chromium	Copper	LEAD	Nickel	ZINC
Birmingham	23.5	0.0003	0.005	0.04	0.1	0.002	0.2
Coventry	46.9	0.0006	0.009	0.08	0.2	0.005	0.4
Dudley	382.5	0.005	0.08	0.61	1.7	0.04	3.3
Sandwell	431.9	0.005	0.09	0.69	1.9	0.04	3.8
Walsall	366.0	0.005	0.07	0.58	1.7	0.04	3.2
Wolverhampton	157.2	0.002	0.03	0.25	0.7	0.02	1.4
TOTALS	1408	0.02	0.28	2.25	6.3	0.15	12.3

Table 8 Estimated annual heavy metal discharges to the atmosphere of the West Midlands in grit and dust from ironfoundry cupolas (tonnes year $^{-1}$)

The heavy metal content of cupola fume is given by reference to the results from foundry D, the hot blast cupola. For this foundry full fume arrestment is practised using a high energy rotary scrubber with a collection efficiency of 99.9%. The fume component is therefore analysed in the arrested material. The fume component will be mostly included within the 75*u*m size fraction; as a result the metal levels are high, illustrating that fume is composed of metal oxides. This data is used to estimate the concentrations of metals in the stack fume emission of a 'typical' cupola which gives lead:— 5% and zinc:— 14%.

Using the assumptions of an approximate 1:1 ratio of mass of grit and dust to mass of fume and the above typical metal levels, estimates of metal fume emissions are obtained for the West Midlands. The results are shown below and are compared with the figures for grit and dust given earlier. This shows that metal emissions in fume are at least an *order of magnitude higher* than the emissions in grit and dust.

	Grit and Dust Emissions	Fume Emissions
Lead	6.3 tonnes year^{-1}	70.4 tonnes year^{-1}
Zinc	12.3 tonnes year^{-1}	197.1 tonnes year^{-1}

Discussion

Because the analysis of collected cupola emissions is limited to a relatively small number of samples taken over only one week, the results and conclusions must be viewed with some caution when making generalisations. Moreover, it must be understood that this work represents the initial stage of a continuing study of airborne heavy metal emissions in the area, and considerable refinements are being made to the method as the work continues.

Nevertheless some clear and interesting points emerge. Firstly, it is evident that heavy metals vary both with size of dust and also between individual foundries. Secondly, fume emissions from cupolas in the West Midlands are in the region of 1,400 tonnes per year respectively. Compared to the emission of lead and zinc in grit and dust, fume emission is responsible for the release of 12 and 16 times more lead and zinc respectively. Moreover, fume emissions form the basis of a more general problem, namely that of air pollution over the entire region. The fine nature of fume particles allows them to be transported in airborne suspension for larger distances than grit and dust. Potential inhalation of fume, although not at a level to be an acute health hazard, may contribute to the general exposure of the population to heavy metals.

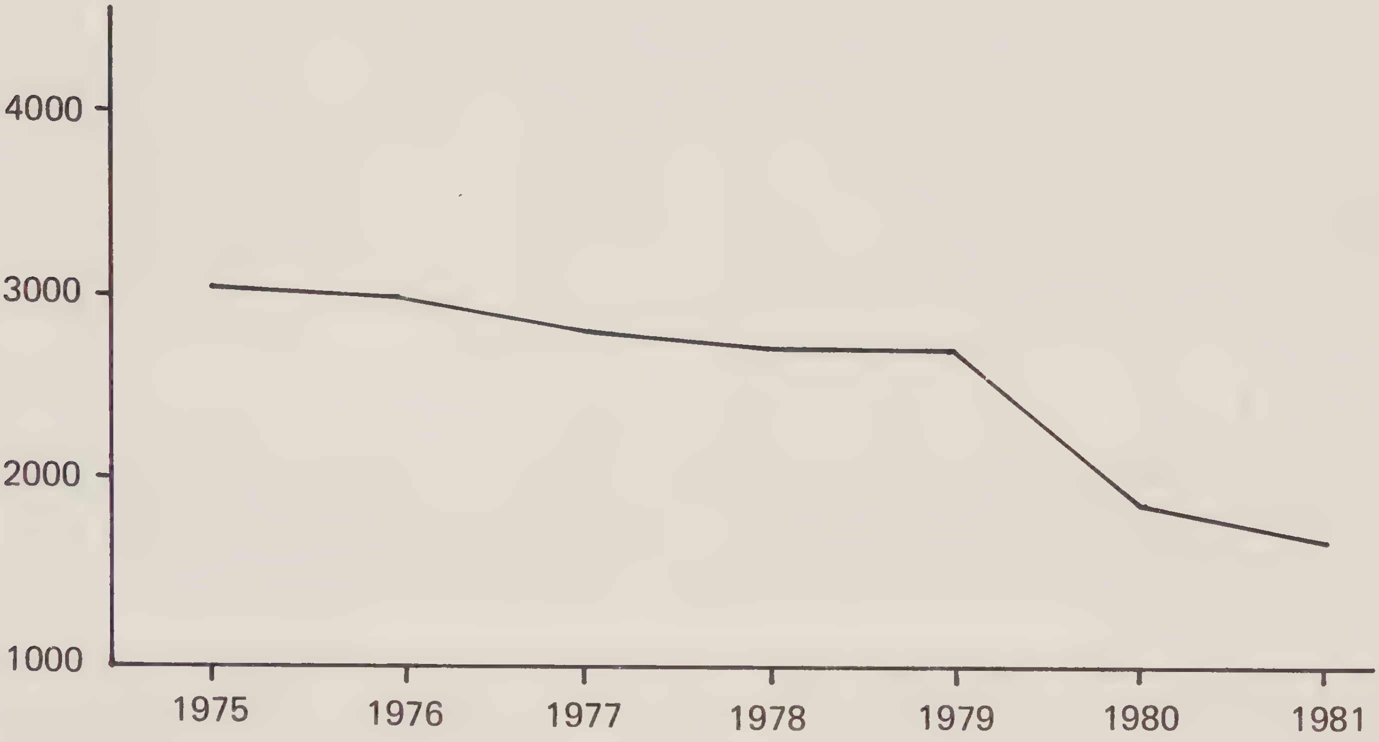
Thirdly, although the quanitity of metal emitted in grit and dust is less than in fume, the greater particle sizes mean that these metals will 'fall out' as deposition in a relatively localised area around the individual plants. The prospect is therefore for metals from this form of emission to accumulate in the vicinity of the sources.

More detailed work on this aspect of metal pollution is being conducted by the author to gain quantitative information on the pattern and rate of heavy metal fallout around cupolas and other industrial sources. One such study around a secondary copper refinery(6) seems to indicate that the bulk of fallout occurs within a limited radius of the source (1000 metres) but it is difficult to generalise across industrial groups.

Cupolas have been shown to be a source of heavy metal emissions to the environment of the West Midlands. The prime cause of the presence of these metals in atmospheric emissions is the use of contaminated scrap as a partial substitute for pig iron. Iron and steel scrap generally sells at 1/3 of the price of pig iron. Advances in cupola technology have enabled foundries to raise the average ratio of scrap to pig iron from 4:1 in 1975 to 12:1 by 1981. As a consequence, although the recent decline in overall castings production(7) (illustrated in Fig. 2) will have been associated with a similar decline in mass emissions of grit and dust, this will *not have been the case for metal emissions* (because the proportion of scrap used has risen). Indeed, it is possible that this increased scrap content may have more than offset the decrease in total production, leading to a possible increase in net metal emissions from this source.

It should be noted that although this study has focussed on metal emissions from 'top gas' stack emissions, metals may also escape in 'fugitive' emissions. The quantities from this route are extremely difficult to estimate, but are generally thought to be relatively small. Some anomalous incidents may occur, however, – one example has been described by JURUE(8) where grit and dust were efficiently collected by an arrestor, but this was then emptied onto a heap in the charging yard allowing wind attrition to blow the material over nearby houses. This may lead to isolated hotspots of metal contamination in street dust, particularly where the levels of lead and zinc in the collected grit and dust are high (as in foundry A).

Figure 2. Iron Castings Production, 1975 – 1981 (thousand tonnes)



(from data – Ironfounding Statistics – May 1982. No. 25.
Council of Ironfoundry Associations).

A final important observation is that, owing to the considerable importance of fume in the total air emissions of metals from foundries, it is only by the introduction of *fume arrestment* (on top of the current proposals on grit and dust) that metal emissions from this source will be significantly reduced.

Acknowledgements

The author wishes to thank Dr. Robert Pocock of the Joint Unit for Research on the Urban Environment for his advice and encouragement, The Science and Engineering Research Council for their financial support, the officers within the Environmental Health Departments of Walsall and Dudley Metropolitan Borough Councils for their help with this project.

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(b) Corporate Members

(i) Corporate Members paying a subscription of £14.00 per annum shall each be entitled to appoint one Representative.
(ii) Corporate Members paying a subscription of £80.00 per annum shall each be entitled to appoint three Representatives.
(iii) Corporate Members paying a subscription of £113.00 or more per annum shall each be entitled to appoint five Representatives.
(iv) A Corporate Member having a Branch or Section situated in a Division other than that Division in which the address of the Corporate Member is situated shall, in such Division, be entitled to appoint Delegates to participate in the activities of the appropriate Division.

RIGHTS OF MEMBERS

4. (a) Each Individual Member, Local Authority Member and Corporate Member and each Representative of a Local Authority Member or Corporate Member, who has paid the appropriate subscription for the current year, shall have the right to:

(i) Nominate Individual Members and Representatives as officers or Members of the Council;
(ii) Be nominated and elected as an Officer or Member of the Council;
(iii) Cast one vote at elections;
(iv) Receive notices of and attend and participate in all meetings of the Society and of the Member's Division;
(v) Move or second, and cast one vote on motions at Meetings of the Society and of the Member's Division;
(vi) Receive free of charge as they are issued the Journal and Members' Handbook of the Society;
(vii) Obtain from the Society, advice and information on questions relating to pollution and its control.

(b) Each Local Authority Member and each Corporate Member who has paid the appropriate subscription for the current year shall have the right to appoint delegates to the Society's Annual Conference and Seminars at a reduced fee, as determined by the Council, for each delegate so appointed.

EUROPEAN MOVE FOR LEAD-FREE PETROL

European consumer and environmental bodies throughout the EEC have come together in a campaign to phase lead out of petrol in Europe. The aim is to abolish the lower limit on petrol lead content (0.15 g/l) embodied in EC Directive 78/611/EEC.

Leading the campaign in the UK are the Consumers' Association, the National Consumer Council and British members of the European Environmental Bureau.
In Europe BEUC (Bureau European des Unions de Consommateurs – the European consumer watchdog body) and the EEB are co-ordinating the campaign in Brussels, while national campaigns have been launched simultaneously in Belgium, Denmark, France, F.R. of Germany, Italy and the Netherlands as well as the UK.

Referring to the campaign's concentration on changing the EC Directive, Peter Goldman, Director of the Consumers' Association, said that unilateral action by any member EEC state to remove lead from petrol altogether could be challenged as a restriction to trade. "The members of BEUC believe that we must change the European legislation to make it possible to have completely lead-free petrol."

Robin Grove-White of CPRE, speaking on behalf of the British members of EEB, said "The European Environmental Bureau is less than happy with the British Government's record on lead in petrol. In 1978, the British Government was a key supporter of the 0.15 grams lower limit which now stands in the European Community's legislation as a central obstacle to a complete ban on lead."

Maurice Healy, head of the Consumer Policy of the National Consumer Council (which is Government-appointed, but with independence written into its constitution) said that while it would not be possible to get lead out of petrol overnight, it was essential to set a starting date soon. "We need to decide on the best grade or grades in which to make lead-free petrol and we need to make proper arrangements for supplies of leaded petrol to continue until existing cars which need it are worn out."

Mike Gerrard of the Association of Community Health Councils, and a member of the Advisory Committee of CLEAR, warmly welcomed the European campaign and the fresh involvement of consumer organisations. While CLEAR have always argued that Britain should be prepared to take a unilateral decision to get lead out of petrol and then campaign to persaude its European partners to do the same, they far preferred the ideal of an EEC decision to fix a date by which all cars in Europe should be manufactured to run on lead-free petrol.

The EEB and BEUC have produced a comprehensive **Discussion Document on Lead in Petrol** *(EEB/BEUC/107/82, of 28.10.82) which reviews the health issue, policies in other countries, the technical issue (implications for the petroleum industry, motor manufacturers and the motorist) and presents the groups' conclusions. Available on loan from the NSCA Library, or from the EEB, Rue Vautier 29, B – 1040 Bruxelles.*

"POLLUTER PAYS" PRINCIPLE

The House of Lords Select Committee on the European Communities, Sub-Committee G (Environment) invited evidence on the "polluter pays" principle. In response, the Society submitted the following written comments:

"First, we wish to say that we regard the "Polluter Pays Principle" as an important basic means for allocating the costs of pollution control. Where it is rigorously and evenly applied we accept that it is conducive to economic efficiency (since the price of the end product will reflect the environmental costs incurred in its production), and equitable (since those responsible for pollution then bear the costs of its control). Nevertheless, the principle is almost impossible to apply evenly and we doubt that the political will exists anywhere within the European Community to apply it rigorously. Attempts to reduce it to a set of rules have led to numerous and lengthy qualifications taking account of, inter alia, national and international investment practices, the nature of the manufacturing process, the degree of pollution control required and the means of financing the research and development of the control mechanisms. In all of these respects, uniformity of practice between Governments, enforcement agencies and the industries concerned are essential if serious distortions in the application of the principle are to be avoided.

Thus, while this Society accepts that the polluter should pay, in accordance with the principle accepted by the United Kingdom as a signatory to the Treaty of Rome, we are doubtful that the countries of the Community are capable of operating it in all its aspects with sufficient uniformity to avoid unfair distortions in international trade and investments. For example:

a. Payments in the form of grant or subsidies may be made from the public purse to the polluters towards: investment in anti pollution installations and equipment; the introduction of new processes; and the cost of operating and maintaining anti pollution installations. These subsidies may be overt or hidden, and in the case of bulk production of basic commodities, e.g. steel, could even lead to allegations of dumping.

b. Charges may be levied directly as taxes on the process which generates the pollution or, alternatively, as the purchase price of a licence which entitles the holder to generate specific quantities of pollutants. While this may permit the polluter to pay a due share of the costs of collective measures by central or local government, e.g. for the cleansing of effluents, the close administrative control required to ensure that the aggregate amount of the charges is equal to the total cost of eliminating the pollution, and is comparable with that applying elsewhere within the EEC, is unlikely to be achieved in practice.

Thus the difficulty of the levy/subsidy aspect of the polluter pays principle is to determine the "right price" to levy or the "right subsidy" to offer from the public purse. Moreover, these are extremely difficult to determine in the case of discharges to the atmosphere. Whether or not this was considered in the drafting of the United Kingdom clean air legislation it is a fact that this aspect of the principle is not embodied in it.

In the United Kingdom at present, no specific grants are given towards pollution control equipment — although it may qualify, like other forms of investment, for more general financial support through grants given for new equipment in Development Areas. The British approach to polluter pays is that individuals or organisations are statutorily required to meet emission or air quality standards promulgated by regulation and thus incur the cost of controlling pollution to satisfy those standards. Moreover, unlike some other Common Market Countries such as France, the use of tax incentives (tax credits/tax relief) to stimulate investment in pollution control equipment in industrial plants is not part of the system. In practice in the UK, the polluter pays principle means that the cost of environmental control is borne by the polluting individual or organisation in the first instance, and passed on to the consumer/community at large in the price of the product: the amount of cost incurred and passed on being determined by a balance between the desirable level of "un-pollution" and the economic costs incurred in achieving it — leading to a compromise on "how un-polluted the country can realistically be" without pricing the product off the market. Thus, as practised in the United Kingdom, the polluter pays principle is the limiting economic element of "best practicable means". In times of recession, or of economic difficulty for a particular industry, it is this element of best practicable means which is flexibly applied through, for example, adjusting the timing of the imposition of controls. Further, as industrial plant comes to the end of its useful life, for example, some iron/steel works, the polluter pays principle element may not be applied rigorously. Such old polluting plant has been permitted to operate to the end of its life in order to protect jobs etc. A perfect example of this is the continued operation of the Phurnacite Plant at Abercwmboi in South Wales.

It can be seen, therefore, that as long as the United Kingdom retains the present concept of the "best practicable means" approach to the control of air pollution, it will be inherently unable to comply with the full EEC approach to the "polluter pays principle". The cleanliness of the nation's air may lag behind the achievable and hence the desirable, particularly in times of general economic difficulty. We consider, therefore, that, depending on the industry and the nature of the process involved, there are strong grounds for requiring the United Kingdom to modify the "BPM" approach to include as necessary the award of public purse subsidies, and other elements such as tax incentives.

We have already asked, in our evidence to the Royal Commission on Environmental Pollution, that energy policy, particularly with regard to coal use, should have clean air as a priority, and that Government grant should be apportioned to ensure minimisation of grit and dust emission where industry is converting from oil/gas firing to coal firing. Short term Government grants to industry at the time of conversion could enable industry to incorporate properly planned pollution and process control equipment from the outset and thus securing long term environmental benefits.

DIVISIONAL NEWS

EAST MIDLANDS DIVISION

The Division met at the Grove Hall, Swadlincote, on Tuesday 2nd September. In the absence on holiday of the Chairman of the South Derbyshire District Council, a civic welcome was kindly extended by Cllr. W. Dunn, Vice Chairman of the Council and Chairman of the Environmental Services Committee. Cllr. Dunn was suitably thanked by the Chairman.

Following a brief business meeting at which the report of the meeting held at Corby on 1st April 1982 was received and some details of future meetings given, the Chairman introduced Mr. J.E. Hopper F.R.I.C.S., District Alkali Inspector, who addressed the meeting on "Works Regulations under the Alkali Act".

Mr. Hopper outlined the legislation available for dealing with atmospheric pollution with particular reference to the Alkali etc Works Regulation Act 1906 and the way in which it is applied. He then went on to describe the processes carried on at Trent Alloys which some members were to visit later in the day. The firm were secondary aluminium smelters which involved melting and refining. Mr. Hopper described the swarf drying plant which needed to operate under reducing conditions and also the precautions required where chlorine gas was used for the removal of magnesium and calcium. Where a very low level of magnesium was called for, intensive use of chlorine was needed and the installation of a scrubber to collect the excess chlorine was essential.

The most serious problem, however, was the rotary furnaces. These were gas fired, the flame heating the refractory lining which in turn imparted heat to melt the metal. Salt fluxing gave rise to fume and to deal with the fume in this instance, a venturi scrubber had been installed.

The dross which was drawn off from the molten metal was ground in a ball mill to recover the metallics which were returned to the processes. The melting process produced dust and this was arrested by a suitable dust collector.

At the end of his talk, Mr. Hopper dealt with a number of questions from the floor. The Chairman then introduced Dr. J. Morley of the Employment Medical Advisory Service of the Health and Safety Executive, who spoke on "Medical Aspects of Lead".

Dr. Morley said that lead had been known for thousands of years and the inorganic variety was widely used in industry. Examples of contact with lead by people at work were lead mining, lead smelting and refining, lead welding and cutting, ceramics, glass and motor car body manufacture, in lead based paints, vitreous enamelling, plastics, solder and printing. An example not necessarily connected with work was from indoor small arms ranges. Following exposure, absorption took place via the lungs and to a lesser extent via the gastro-intestinal tract. It was carried on the surface of the red blood cells and distributed throughout the body. It became stored in the bones and accumulated with age. It was present in body excretions including breast milk.

The effects of lead varied from no detectable changes to clinical signs and symptoms. Lead interfered with the formation of HAEM and caused anaemia. The early signs of lead poisoning were mild and non specific, including tiredness, headache, bowel disturbance and indigestion. Later there was anaemia, acute abdominal colic, weakness in the most used muscle groups, wrist drop, a blue line on the gums, coma, delirium and convulsions. The unborn child could also be affected.

Turning to organic lead, Dr. Morley said some compounds had a toxicity similar to inorganic lead. Particularly well known examples were tetra-ethyl-lead and tetra-methyl-lead. Typical hazards were from manufacturing and from cleaning of tanks. Absorption could be by inhalation, via the skin and readily followed ingestion. It was converted in the liver and was highly toxic to brain cells. The classic signs did not appear in the central nervous system.

Treatment was by removal from exposure and drinking milk, which was formerly free to many lead workers, since the calcium assisted in storage in the bones. This was known as chelation therapy. Treatment also included sedatives and rest.

Dr. Morley outlined methods of prevention of lead poisoning and the Control of Lead at Work including:

Control of fume and dust.
Substitution with lead free materials using lead in paste form or as an emulsion and thereby minimising dust.
Using wet methods where practicable.
Keeping temperature below 500°C.
Containment in totally enclosed plant.
Provision of proper changing, washing and eating facilities.
Medical surveillance by periodic examinations.

If there were indications of a much increased lead absorption a person might be suspended from work.

Dr. Morley also answered a number of questions, the range of which emphasised the scope of the problem of lead in the environment, the different areas of responsibility and the continuing debate about the importance and the contribution to the problem of the various sources of lead.

At the end of the morning session, the Chairman warmly thanked both speakers and also the South Derbyshire District Council for acting as our hosts and kindly entertaining us to lunch. Members then adjourned to the Leisure Centre Lounge, where an excellent buffet lunch was provided.

In the afternoon, one party of those attending visited the Trent Alloys factory at Willington where Mr. Hopper and his colleague, Mr. R. Walters, assisted in conducting the party round the works. The remainder went to the factory of Nestles Ltd at Hatton to see the production of coffee powder and were also shown a boiler which utilised coffee grounds as a fuel.

The Division is indebted to both of these firms for opening their factories to us.

E.F. Raven
Hon. Secretary

KEEPING UP THE FACADE

The British Standards Institution has been taking a close look at the external and internal walls of buildings and the perils and pitfalls involved in their cleaning and surface repairs. The result is a major new publication, BS 6270 *Cleaning and surface repair of buildings,* the first national code of practice in the world on this tricky craft, and one which will be invaluable to property owners and insurers, as well as architects, surveyors, engineers and contractors. It will be issued in three Parts, the first of which BSI has just published under the title, Part 1 *Natural stone, cast stone and clay and calcium silicate brick masonry.*

Maintaining the exterior of buildings has always been an important activity, of course. But only since the introduction of the various Clean Air Acts in the 1950s has it been worthwhile to undertake the removal of surface dirt and grime. However, the general lack of reliable guidance available has often led to the use of unsuitable methods and materials.

The new code of practice will do much to remedy this. Part 1 describes the main methods and materials in common use, and the problems likely to be met in carrying out cleaning, repointing, surface repairs and the replacement of decayed natural stone and brickwork. In view of the widely-differing ages, materials and locations of masonry buildings, only general guidelines are given so that the user may select the most appropriate method for a particular structure.

The code also deals with related health hazards and the precautions to be observed to protect workers and other members of the public. Other aspects covered include experimental treatments for masonry consolidation and preservation, though these should be used only after consultation with conservation specialists. Expert advice may be obtained on such problems from the various organizations represented on the BSI technical committee and listed on the back cover of the code.

Further Parts of the code are in preparation and will comprise Part 2 *Concrete, rendered finishes and screeds* and Part 3 *Other materials (glass, metals, timber etc).* Useful guidance is also available in the following related British Standards: BS 5390 *Code of practice for stone masonry,* BS 5628 *Code of practice for the structural use of masonry,* and CP 121 *Walling* Part 1 *Brick and block masonry.*

SMOKE AND SULPHUR DIOXIDE EMISSIONS AND CONCENTRATIONS IN IRELAND

M.L. Bailey
Environmental Services Section, An Foras Forbartha, Dublin 4, Eire

INTRODUCTION

In Ireland, until recently, there has been generally little concern shown towards problems relating to air pollution. To many people, Ireland (with a population of £3½ million) is unpolluted with plentiful supplies of clean air, water and large areas of unspoilt landscapes. When viewing air quality on a national scale this is possibly the case in comparison to the more industrialised countries in Europe. National emissions are currently estimated at 200,000 – 220,000 tonnes of sulphur dioxide per year and about 90,000 – 100,000 tonnes of smoke to give average annual emission rates of 3 tonnes/km^2 and 1 tonne/km^2 respectively. In 1980 an estimated 98,000 tonnes of sulphur dioxide were emitted from electricity generating stations, a similar amount from industry and commercial premises and about 22,000 tonnes from domestic sources (see Fig. 1). For smoke the situation is somewhat different with 65,000–70,000 tonnes emitted annually from domestic dwellings, compared to only 11,000 tonnes from the power stations and less than 5,000 tonnes per year from industry and commercial buildings. In contrast to the millions of tonnes emitted from the United Kingdom or West Germany such amounts are small and probably of little international concern.

On a regional scale, however, the picture that emerges is somewhat different and in Dublin, in particular, the air quality is now viewed with greater concern than in the past, due to the rapid urbanisation, coupled with a significant increase in the use of solid fuel within the domestic sector. The Dublin conurbation is expanding rapidly and with about a million people already located within an area of about 230 km^2 it is one of the fastest growing cities in Europe. Urban growth is also occurring in the other centres such as Cork, Limerick, and Galway and so the air quality in these smaller areas also warrants attention.

Until recently, peat and minor deposits of poor quality coal were the only native fuels. All oil and virtually all coal is imported and so the 1979 oil crisis and current world prices led to a positive need to reduce the strong dependence on oil by using alternative fuels, especially coal within the domestic sector. The Irish Government actively encouraged such a switch to solid fuel by issuing grants for domestic solid fuel conversions. The potential impact on the air quality of the towns and cities by this switch in fuel was dramatically demonstrated in Dublin during the winter of 1981/2.

Natural gas from the Kinsale fields off the coast of Cork will, in the next year or so, become increasingly available as an alternative fuel. Although it is expected to replace

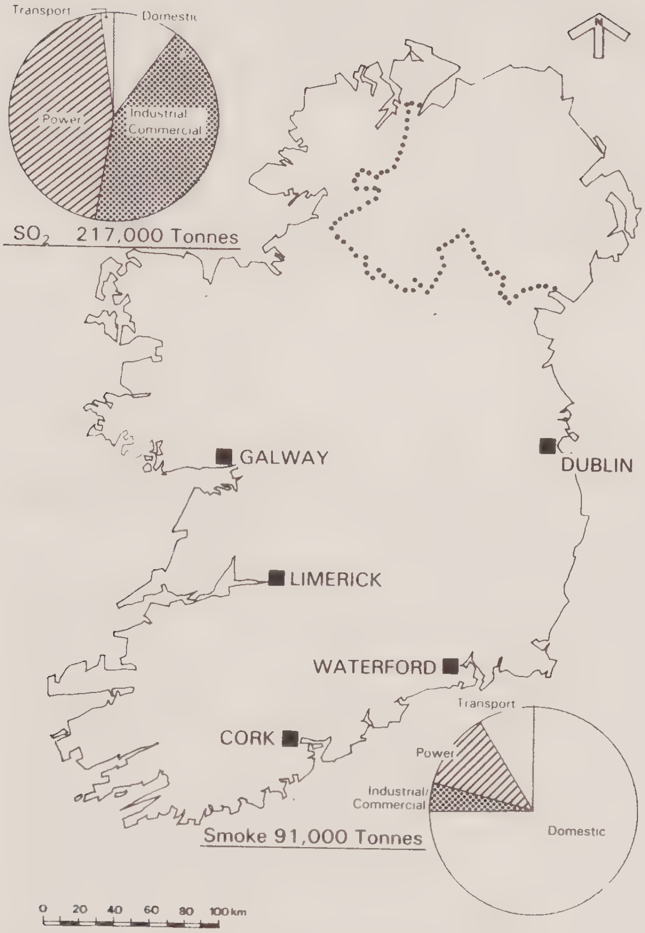

Figure 1. 1980 National Emissions

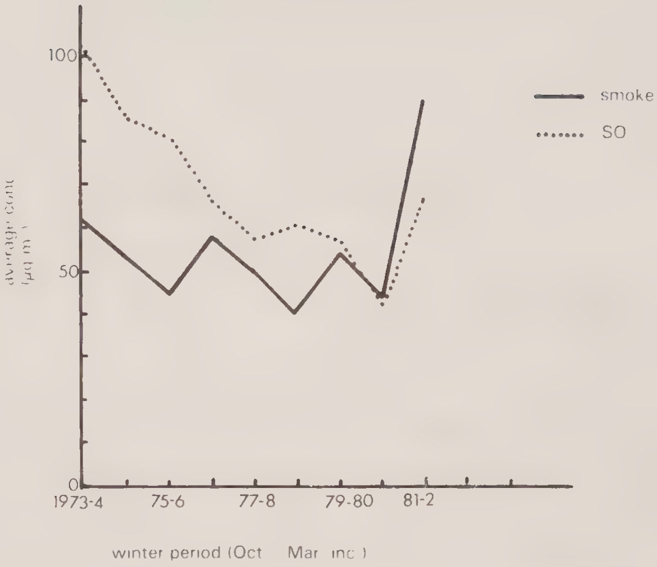

Figure 2. Air Pollution Levels in Dublin during the Winters 1973/4 – 81/2

Total SO$_2$ Emissions = 60,000 tonnes

Total Smoke Emissions = 17,000 tonnes

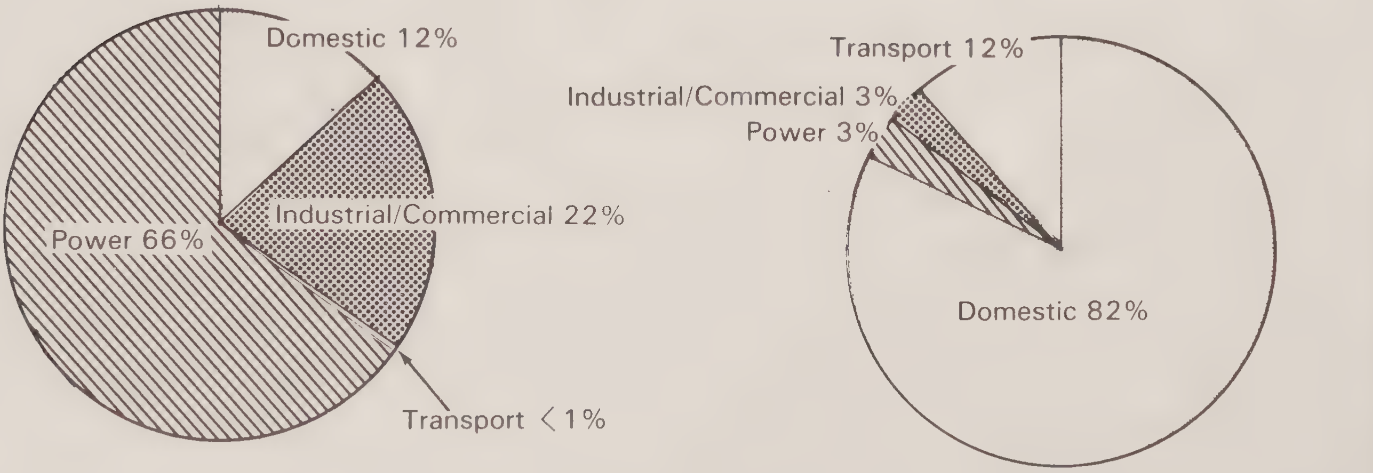

Figure 3. 1980 Dublin Emissions

oil in many industries and also for electricity generation, its penetration into the domestic heating market is much more uncertain. Such a shift in fuel usage to gas is, however, required, in particular within the solid fuel market to provide a solution to reducing smoke, and to a lesser extent, sulphur dioxide levels in the residential suburbs of the cities.

DUBLIN AIR QUALITY

A network for monitoring ambient smoke and sulphur dioxide levels was established by Dublin Corporation in 1973. Two other networks have also operated in the Dublin area (1), but since 1979 the data has been discontinuous and hence difficult to interpret. Only results of the Dublin Corporation network are presented in this section. The network comprises of 13 eight-day monitors at which samples are taken using the BS 1747 procedure (2). Results over the years show that between 1973 and 1980 there was an overall decline in sulphur dioxide levels, and to a lesser extent smoke (Fig. 2). Average winter concentrations of sulphur dioxide decreased by over 50% from 101 ug/m^3 to 42 ug/m^3 during this period and smoke levels similarly declined from a winter average of 62 ug/m^3 to 44 ug/m^3* by 1980/1.

Resulting, however, from the greatly increased use of coal for household heating, the improvement in Dublin air quality now appears to have been arrested if not reversed. Initial indications of this were evident during the 1981/2 winter when there was a sharp deterioration in air quality due, in particular, to high smoke levels. The average winter smoke level for the whole network increased by about a factor of two in 1981/2 to 90 ug/m^3, and was 50% higher than any preceding winter since the present network was established. Moreover, for the first time the average winter smoke level exceeded that for SO_2. The network winter average sulphur dioxide level also rose from 42 to 67 ug/m^3 between 1980/1 and 1981/2, although this was no higher than that observed in the mid-70's.

Ambient winter average smoke concentrations recorded in the inner city ranged from 76 - 141 ug/m^3 (winter median range 36 - 80 ug/m^3) and from 53 - 103 ug/m^3 (winter median range 46 - 94 ug/m^3) for sulphur dioxide during the 1981/2 winter.

The number of sites which exceeded the limits specified in the EEC Air Quality Directive (3) for the period from 1973/4 to 1981/2 are shown in Table 1. The deterioration in air quality is clearly evident in 1981/2 compared to the late 70's when only one or two sites breached daily limit values. Eight out of the 13 sites failed to comply with the Directive with seven sites recording a daily 98 percentile smoke level of more than 250 ug/m^3. One such site also exceeded the limit value given for daily sulphur dioxide levels and the annual limit values were breached at two centre city sites. Table 1 also shows that the number of daily site observations greater than 250 ug/m^3 increased to 145 in 1981/2 in comparison with previous years. The maximum daily smoke level recorded at any site was 1812 ug/m^3 and some 40 observations exceeded 500 ug/m^3.

* *Smoke concentrations are given as the OECD equivalent.*

Daily SO_2 levels were generally lower with a maximum concentration of 418 ug/m^3 being detected. Very high levels of smoke were observed during an air pollution episode from January 10th – 15th 1982 when a ground based inversion and low temperatures (min. daily average -3.2^{o}C) were recorded. However, although such climatic conditions might be regarded as infrequent for Dublin, there were still 105 observations of smoke higher than 250 ug/m^3 for the rest of the winter. Such results indicate clearly the overall deterioration in air quality for the whole winter and not just one particular month.

Annual	Annual	Winter	Daily		No. of daily smoke observations >250 ug/m^3
			98%	>3 days	
1973/4	4	0	2	2	28
1974/5	2	1	3	1	6
1975/6	2	–	1	1	0
1976/7	–	–	1	2	35
1977/8	–	–	1	1	33
1978/9	–	–	–	–	4
1979/0	–	–	1	–	39
1980/1	–	–	–	–	8
1981/2	2	–	7	7	145

N.B. No. of sites with valid data – 12 (1973/4 – 1979/0), 13 (1980/1 – 1981/2).

Table 1 Number of Dublin Corporation Sites exceeding the various EEC Directive limit values and the number of site observations greater than 250 ug/m^3 of smoke.

The trend in air quality during the 1970's described above differs somewhat from estimated trends in emissions for the Dublin area. Having declined during the early 1970's smoke emissions from stationary sources rose by about 60% between 1975 (9,500 tonnes/yr) and 1980 (15,000 tonnes/yr). Smoke emissions from motor vehicles are currently estimated at about 2,000 tonnes/yr. Domestic smoke emissions are estimated to have been about 14,000 tonnes in 1980 (Fig. 3) or 90% of the total from stationary sources with coal accounting for much of this. An estimated 360,000 tonnes of coal were burnt in houses during 1980 of which only about 10% was smokeless fuel. Peat and small amounts of wood are also burnt in Dublin, both of which may add significantly to smoke emissions from housing estates. Due to the sharp increase in domestic solid fuel usage and the high density housing to be found in parts of the city, some areas probably now exceed smoke emissions of 200 tonnes/yr. km^2 (4). Emissions of sulphur dioxide also increased from an estimated 49,000 to 60,000 tonnes/yr from 1976 to

1980 in the Dublin area; about 60 – 70% of which was emitted from two power generating stations. Domestic sulphur dioxide emissions contributed about 7,000 tonnes or some 12% of the total in 1980. Although this is less than 20% of the sulphur dioxide emitted from the power station chimneys, domestic emissions take place only 10 – 15 metres above the ground and so are less easily dispersed than from the power stations' chimneys which are over 200 metres high. The contribution of domestic sources to ambient ground level air pollution concentrations will therefore be highly significant. The discrepancy between the trends since the mid-1970's of the ambient concentrations and atmospheric emissions in Dublin is difficult to explain and underlines the need for systematic monitoring. It may be due, at least to some degree, to the lack of monitoring in the extensive residential suburbs where an increase in smoke emissions has been most pronounced in recent years. Since most of the site locations are within the inner city, the results may not reflect the actual deterioriation in air quality in the suburbs.

OTHER URBAN CENTRES

Urban air quality is also monitored in Cork and to a lesser extent in Galway, Waterford, Limerick, Drogheda and Dundalk. Although data on the air quality of such centres are less comprehensive in general, the trends in air quality appear to be similar to those of Dublin, even though levels in 1981/2 were lower than those recorded in Dublin. The average winter concentration of smoke and sulphur dioxide for the network in Cork city ranged from 25 – 48 ug/m^3 and 28 – 40 ug/m^3 respectively between 1975/6 and 1981/2. An increase in smoke levels is evident since 1979 when smoke levels were much lower than those recorded in the 1981/2 winter when a daily average of 250 ug/m^3 of smoke was exceeded at the residential sites on a few occasions. Cork city is situated in the valley of the River Lee and so valley inversions and cold air drainage down the slopes may cause a significant build-up in air pollution levels as indicated by results from monitoring sites near the city centre.

In the other urban centres average winter smoke levels ranged from 5 – 76 ug/m^3 and 11 – 58 ug/m^3 for ambient sulphur dioxide concentrations between 1975/6 and 1981/2. The lowest levels of air pollution were recorded in Galway with one site in particular recording winter average levels of less than 10 ug/m^3 for smoke during this period. Few observations in the other towns exceeded daily averages of 100 ug/m^3 for either pollutant during the 1981/2 winter. However, as in Dublin, there has been recent urban expansion around these towns and as most of the site locations have remained unchanged since they were established the results may not reflect the true pattern of air quality in the urban centres.

SUMMARY AND DISCUSSION

Overall, the available data indicate that between 1976 and 1980 the ambient concentrations of both smoke and sulphur dioxide in Dublin and other urban centres were mainly less than the limits specified in the Air Quality Directive. However, there was a significant deterioration in air quality observed in Dublin during 1981/2 due, in particular, to high levels of smoke and serious levels were reached at some sites, especially during the episode of smog in January 1982. Average winter smoke levels were 50% higher than any winter since 1973, although ambient concentrations of sulphur dioxide were no greater than those recorded in the mid-1970's. With regard to the Air Quality Directive the daily limit value for smoke was exceeded at 8 out of the 13 sites operational in Dublin with two sites also breaching the annual limit values. At other urban centres there was also a rise in ambient levels, though it was not of the same magnitude. Continuation of this trend, especially in Dublin, could result in adverse health effects, similar to those encountered in the United Kingdom prior to the widescale introduction of smoke control measures. Some evidence of adverse health effects was demonstrated in the mid-1970's and one such study suggests that even then, during unfavourable weather conditions, the levels of air pollution may have had deleterious health effects in terms of sickness and morbidity of a respiratory nature (5).

Even before the 1981/2 winter, levels at a number of sites exceeded the more stringent EEC guide values recommended as reference points for zones in which the Member States consider it necessary to prevent foreseeable increases in air pollution due, in particular to urban and industrial developments. Such a situation, along with the recent results described above, clearly leaves little cause for complacency. Although controls exist for atmospheric emissions from industrial and commercial premises in Ireland (6) these do not apply to domestic sources, which are undoubtedly a major source of low level air pollution, especially for smoke. This situation is certainly unsatisfactory and if the deterioration in air quality continues the introduction of suitable control measures will need to be considered. However, the introduction of natural gas into Dublin is to be welcomed as an alternative fuel. If the penetration is significant, especially within the domestic solid fuel market, there would be a reduction in ambient levels of air pollution. The greater use of solid smokeless fuels, replacement of domestic open fires with more efficient appliances, and the designation of certain parts of the city as smokeless zones may be other alternatives to examine.

As the rapid urbanisation and industrial development in Ireland continues, extensive monitoring of air quality in these areas is important to ensure that the well-being of the population will not be seriously at risk. A major challenge facing Ireland over the next decade will be to attain a proper balance between economic growth and environmental quality, of which air pollution is an important aspect.

ACKNOWLEDGEMENTS

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EMISSIONS TRADING: SAVE OUR AIR – SAVE OUR MONEY

by

Gordon L. Brady, Ph.D

Senior Economic Policy Advisor, President's Council on Environmental Quality, Washington D.C., USA

This paper is based upon research undertaken by the author. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the author and do not necessarily reflect the views of the President's Council on Environmental Quality.

The character and practice of air quality management is continually evolving. Great strides in our understanding of air pollution have been made since the broad framework of the Clean Air Act was passed in 1970. Our better understanding of the nature of air pollution requires regulatory changes to match the state of the art. One of the first major regulatory reform efforts at EPA under the Reagan Administration is the emissions trading programme; the programme provides that states may develop, for federal approval, a system that allows firms to trade permits to discharge pollutants. Participation on the part of the states and firms is purely voluntary.

A trading system in discharge permits represents the natural evolution of such innovative administrative procedures as the "bubble", "offsets", and "banking" – developed by EPA in response to increased understanding of air quality management and the limitations of current regulatory approaches.

The "bubble" policy allows variation, instead of requiring uniformity in pollution controls among points of discharge within a single industrial process, provided that overall regional air quality goals are maintained.

The "offset policy" allows the owner of a new plant to operate provided that it obtains equivalent reductions in the discharges of pollutants from owner(s) of existing plants.

"Banking", the most recent EPA programme, allows suppliers of discharge reductions to receive "credit" for those reductions. The "credits" may be used (or sold) later and can allow the user to exceed otherwise prohibited applicable standards.

The emissions trading programme consolidates the bubble and offset procedures in a single transactional instrument called an Emission Reduction Credit. The creation of the Emission Reduction Credit is limited to reductions by existing dischargers below minimum requirements. Traders are required to demonstrate equivalent ambient effects from transactions in Emission Reduction Credits.

The EPA emissions trading programme represents a practical approach to solving the air quality problems in the tangible terms of economic benefit. "Emissions trading" sets an absolute limitation on the quantity of specific pollutants present in the atmosphere for a region. The amount of pollution allowable by individual firms in the region is fixed by permits to operate. Once these discharge limitations are set, the emissions trading programme allows firms to trade among themselves – based on which firms can achieve the most cost-effective reduction in their discharges. This means that some firms may control more than others while the region as a whole meets its ambient air quality goal.

The command and control regulatory approach now in use prescribes discharge requirements on a point source basis. The administrative, monitoring, and surveillance costs of this approach are high. For example, a petroleum refinery may contain a combination of point sources including 8,000 valves (500 for gas; 6,000 for heavy liquids, 1,500 for light liquids) 24,000 flanges, 450 pumps (50 for light liquids, 400 for heavy liquids) 50 process drains and 3 flares, each with its own abatement requirement. Prescription of control requirement to this level disregards the skill and enterprise incentives of firm managers in fashioning approaches that meet air quality requirements in the most cost-effective manner.

The emissions trading programme allows relaxation of discharge limitations on one location within an activity while requiring a greater degree of abatement at other locations within the firm or within the region. Shifting the regulatory focus from point source control to the activity level has important administrative and efficiency implications. The "activity" that produces pollution may consist of a set of one or more unit processes and unit operations. Examples are the industrial plant, a farm, a mining operation, a restaurant, an office building, a household, a management unit of a national forest, or a motor vehicle. Each generates by-products according to some time pattern; it is at the activity level rather than at the individual point source that reductions in discharges can be most efficiently brought about.

Economists have long advocated a fully-fledged system of tradeable discharge permits. It makes air quality improvement a paying proposition to firms by taking advantage of the "enterprise" incentive to "truck" and to "barter." Such approaches provide an economic incentive to achieve reductions in pollution.

There are many opportunities for trades to reduce the pollution control costs for firms and total control costs for a region. At present, the marginal costs of pollution abatement may vary significantly across an industrial category. One study found that the cost of control for hydrocarbons ranged from $16,500 per ton for a large spray painting operation in an automobile factory to $41 per ton for a gasoline terminal in the same region. The same study found the cost of control to vary by as much as 50 percent for the same point sources within the same facility. Trading allows reduced control of high-cost activities if compensated by additional control of low-cost sources within the same activity or in other firms. Trading in this context has been shown to produce substantial cost reductions. The Narragansett Electric Company of Rhode Island achieved annual savings of $3 million and 600,000 barrels of imported crude oil while reducing discharges of sulfur dioxide by 39 percent over current requirements. Trading is reported to have saved Armco Steel from $12 to $14 million in capital costs for particulate abatement equipment.

The command and control regulatory approach does not reward firms that improve upon current requirements after initial compliance is achieved. The EPA emissions trading programme offers improved cost-effectiveness in meeting ambient air quality goals by allowing firms to adjust their response to air quality management regulations within a market-like context. Emissions trading amounts to an invitation and opportunity for existing dischargers to employ their skill in managing by-products to go beyond what is legally required of them. The incentive for finding or relating "surplus" discharge reductions below legal requirements is the ability to expand their own firm, or sell the resultant permits to other firms needing them. Trading has a payoff for the companies and the region; new growth can be accommodated while the regional air quality requirements are preserved.

Emissions trading is a flexible system; its effectiveness will be limited by deficiencies in the existing regulatory system as well as past administrative and judicial decisions. These will affect the firms that trade, the baselines for trades, and the certainty of ownership of various types of discharge reductions. Emissions trading does not alter the nature of the air pollution problem. It does offer a more attractive set of incentives to firms and air quality managers to take advantage of differentials in control costs within their own and other firms. While offering a system for achieving air quality goals, the emissions trading program does not escape the scientific and technical requirements of the existing programme. Any scientific or technical problem in the existing regulatory framework will also be encountered in the implementation of an emissions trading programme. Emissions trading must rely on air quality modeling, a permitting process, a system of monitoring, and an enforcement system that imposes effective sanctions for violations of adjusted permit conditions and limitations. Thus it does not represent the destruction of an existing programme but rather the evolution of a system and concept which reflects the progress of regulatory and scientific accomplishments protecting air quality.

ATMOSPHERIC POLLUTION IN CAR PARKS

Guidance published by Health and Safety Executive

Drawing on work by Ivor Barker and Dr. Malcolm Fox, HSE have published new guidance on reducing the build-up of carbon monoxide and other emissions in multi-storey car parks and other confined spaces in which car engines are run.

Car park design should take account of the need for good natural ventilation so fumes can be readily dispersed. Buildings should be sited and operated so that queues of traffic do not build up inside them. Reliable mechanical extraction ventilation systems may be necessary where good natural ventilation is not possible.

Replacement fresh air from an uncontaminated source should be provided by means of induction ventilation to areas regularly occupied such as pay booths, which should have the smallest convenient ticket opening so that polluted air does not eddy in, says the guidance.

Some of the ways of improving existing installations, it is suggested, include:
- maximising natural ventilation, if necessary by removing cladding;
- adopting a system of operation which allows cars to move out freely at all times;
- redesigning exit routes, for example to be downstream of traffic lights; and
- providing mechanical extraction and forced make-up fresh air ventilation.

Where there is reason to think that there may be a problem, monitoring for carbon monoxide should be carried out during peak traffic flow.

The guidance discusses carbon monoxide limits of exposure for those who regularly work in car parks and although these do not apply to the general public where the very young, old and sick need to be taken into account, it is considered that provided they are observed, the exposure of the public who are on the premises only for a short time should not give cause for concern.

The medical effects of carbon monoxide and other exhaust pollutants are also discussed in the guidance together with the results of atmospheric sampling surveys carried out to follow up enquiries or complaints at a number of car parks. Results have indicated that the carbon monoxide concentrations in multi-storey car parks varied widely according to day and time, depending upon traffic conditions.

'Atmospheric Pollution in Car Parks' *(Guidance Note EH33), HM Stationery Office or booksellers, price 50p plus postage. ISBN 0 11 883550 5*

INDUSTRIAL NEWS

New General Secretary for CONCAWE

Dr. HANS-WILHELM WITTMEIER has succeeded Mr. JEAN DAVID as General Secretary of CONCAWE (the Oil Companies' International Study Group for Conservation of Clean Air and Water — Europe). Dr. Wittmeier is seconded to CONCAWE from Esso A.G.

During his 28 years' service with Esso in Germany — broken only by one year's secondment to Esso's head office in New York — Dr. Wittmeier has been concerned with logistics, planning, marketing operations, natural gas, supply operations, chemicals and refining. His most recent appointment was as Manager of Esso's Cologne refinery, a post he held for seven years.

Reader Enquiry Service No. **8231**

Beau Contract

F.E. Beaumont Limited of Mere, Wiltshire has been awarded a contract by the States of Guernsey Electricity Board for the manufacture and erection of two 55m high Cor-Ten steel Multiflue chimneys with associated horizontal flues. The contract also includes for Beaumont's patented Gas Solids Collectors and is valued at approximately £500,000.

Reader Enquiry Service No. **8232**

Silent Piling

Hush Piling Ltd., of Brentwood, Essex, developed the Hush — a piling rig which will operate in any soil condition — in 1971. Since then the company have carried out a number of projects in residential areas where noise pollution presents a considerable problem. The technique has been used especially on British Rail projects where working at night is often necessary. The Hush rig meets the requirements of BS 5228, and has a sound reading of 70 dB(A) at 16 metres.

Hush Piling Ltd. has recently become associated with Foundation Engineering Ltd., within the Costain Group.

Reader Enquiry Service No. **8233**

Improving Crematoria Performance

Operational problems arising at a crematorium recently resulted in Cremer and Warner being commissioned to study the causes and suggest possible remedial action that could be taken to overcome them.

The main problem centred around smoke and fume emission into the working space due to the generation of positive pressures inside the cremator. The fume produced an objectionable atmosphere for the operators and fears were expressed regarding the possible toxic effects of substances present in this fume. The matter was of particular concern to the operating authority in view of their responsibilities under the Health and Safety at Work Act.

Gas sampling was carried out by Cremer and Warner to determine whether toxic substances were present and at the same time the combustion process was investigated to determine why overpressure occurred in a system which had originally been satisfactory.

The results of this investigation indicated that changes in coffin construction materials, coffin linings and cadaver wrappings have all led to higher heat release rates during the early stages of cremation. Many cremators at present in service were not designed to cope with such conditions and pressurisation of the combustion chamber occurs during these periods.

Design changes recommended by Cremer and Warner have been implemented at the cremator studied which, it is believed, will substantially reduce or eliminate the problems and so avoid the alternative of installing a new cremator at a cost some three times greater than the costs of modification.

Reader Enquiry Service No. **8234**

Scrubber Helps Recover Heavy Metals

The recent installation of a venturi gas scrubbing system at Engelhard Industries Ltd. at Cinderford in the Forest of Dean is preventing the escape of heavy metals to the atmosphere from incineration furnaces used during the recovery of precious metals. The system was designed and manufactured by MikroPul Ducon Limited, Shoeburyness, who were able to guarantee a maximum concentration of 10mg/m^3 each for copper and lead, and 5mg/m^3 for cadmium in the gases passing up the chimney. In addition MikroPul Ducon guaranteed an average of only 50% of these concentrations over any working day.

A wet scrubbing system was selected because it is the only simple method of meeting the requirements of the Alkali Inspector for permissible levels of metals and acids in the exhaust fumes. In addition, wet scrubbing solves the problems associated with handling unpleasant materials driven off in the combustion process.

The new MikroPul Ducon system was installed to replace an existing scrubber which would have had insufficient capacity when a second incinerator was brought into use. It includes a spray cooler to reduce the temperature of the gases as they leave the furnaces from 500^{o}C to around 70^{o}C. The gases then pass through a venturi throat where water is added to capture the particles of copper, lead and cadmium contained in the gas stream. The resulting suspension of metal particles in water is removed from the gas stream in a separator before the gases pass through a fan and are discharged through a 26m high chimney. Throughout the system a design rating for a gas flow of 310m^3/min was adopted.

One of the problems to be overcome in the design of this system, as in other similar systems, was that of the risk of severe corrosion caused by the acidity of the exhaust fumes leaving the incinerators. To overcome this MikroPul Ducon used Hastelloy C276 for the manufacture of the cooler and the fan impeller. Everything else was manufactured in glass reinforced plastics with the exception of the fan casing which is rubber lined steel.

As part of the commissioning process, sampling was carried out by MikroPul Ducon in accordance with BS.3405 to prove that the performance of the system met both the requirements of the Alkali Inspector and the guarantees. Samples of the scrubbed gas were compared with samples taken from the ducts leading from each incineration furnace. Routine stack sampling is carried out by Engelhard Industries once a week as a monitoring procedure and to provide records for the Alkali Inspector.

Reader Enquiry Service No. **8235**

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